CFC REDUCTION—TECHNOLOGY TRANSFER TO THE DEVELOPING WORLD

HEARING

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

AND THE

SUBCOMMITTEE ON INTERNATIONAL
SCIENTIFIC COOPERATION

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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July 11, 1990:

Richard J. Smith, Acting Deputy Assistant Secretary, Environment, Health and Natural Resources, Department of State; accompanied by Eileen Claussen, Director, Office of Atmospheric and Indoor Air Programs, EPA; Robert Reinstein, Director, Energy and Natural Resource Trade Policy, Office of the U.S. Trade Representative; and Robert T. Watson, Chief, Upper Atmosphere/Research/Tropospheric Chemistry Branch, Office of Space Science and Applications, NASA 13

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CFC REDUCTION—TECHNOLOGY TRANSFER TO THE DEVELOPING WORLD

WEDNESDAY, JULY 11, 1990

U.S. House of Representatives,
Committee on Science, Space, and Technology
Subcommittee on Natural Resources, Agriculture
Research and Environment; and Subcommittee on
International Scientific Cooperation,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m., in Room 2325, Rayburn House Office Building, Hon. James H. Scheuer [chairman of the Subcommittee on Natural Resources, Agriculture Research and Environment] presiding.

Mr. Scheuer. The joint hearing of the subcommittees of the Committee on Science and Space and Technology, the Subcommittee on International Scientific Cooperation and the Subcommittee on Natural Resources, Agriculture Research and Environment, will come to order.

I am Jim Scheuer, and I am Chairman of the latter subcommittee, the Subcommittee on Natural Resources, Agriculture Research and Environment. My colleague, Ralph Hall of Texas, who is Chairman of the subcommittee on International Scientific Cooperation, is recovering from an operation in Texas and unfortunately is not able to be here today. He is here in spirit, however, and we all wish him well. He is a wonderful colleague and a man with whom it is a great joy and privilege to work.

[The prepared opening statements of Mr. Scheuer and Mr. Hall follow:]

OPENING STATEMENT

HONORABLE JAMES H. SCHEUER

JOINT HEARING

CFC REDUCTION -- TECHNOLOGY TRANSFER TO THE DEVELOPING WORLD

PART 1: REVIEW OF AMENDMENTS TO THE MONTREAL PROTOCOL

JULY 11, 1990

ON BEHALF OF THE SUBCOMMITTEE ON NATURAL RESOUCES, AGRICULTURE RESEARCH, AND ENVIRONMENT, AND THE SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION, I AM DELIGHTED TO WELCOME ALL OF OUR DISTINGUISHED WITNESSES HERE TODAY.

UNFORTUNATELY, THE CHAIRMAN OF THE SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION, MY COLLEAGUE RALPH HALL, IS STILL RECOVERING FROM SURGERY AND REGRETS THAT HE CANNOT BE HERE TODAY FOR THIS JOINT HEARING.

TODAY, THE SUBCOMMITTEES ARE HOLDING THE FIRST OF TWO DAYS OF HEARINGS ON THE PROPOSED PHASING OUT OF CHLOROFLOUROCARBONS (CFCS) AND OTHER OZONE-DEPLETING GASES UNDER THE MONTREAL PROTOCOL TO PROTECT THE STRATOSPHERIC OZONE LAYER.

IN PARTICULAR, THE SUBCOMMITTEES ARE INTERESTED IN THE ROLE OF THE UNITED STATES AND OTHER INDUSTRIALIZED NATIONS IN ASSISTING THIRD WORLD COUNTRIES TO DEVELOP THEIR ECONOMIES WHILE AT THE SAME TIME REDUCING THEIR USE OF OZONE-DESTROYING CHEMICALS.

WE HAVE FOLLOWED THE DEVELOPMENTS IN THE RECENT NEGOTIATIONS ON THE MONTREAL PROTOCOL WITH GREAT INTEREST.

THE ADMINISTRATION'S INITIAL BARGAINING POSITION -- THAT IT WOULD NOT CONTRIBUTE TO AN INTERNATIONAL FUND TO ENCOURAGE DEVELOPING COUNTRIES TO SHIFT FROM OZONE-DEPLETING CHEMICALS -- WAS MET WITH INCREDULITY AND DISMAY IN CONGRESS, AND INDEED, AROUND THE WORLD.

WE WERE THEREFORE HEARTENED BY THE ADMINISTRATION'S REVERSAL OF THIS ILL-CONCEIVED POSITION ON THE EVE OF THE LONDON NEGOTIATING SESSION LAST MONTH.

INDEED, FROM ALL ACCOUNTS, THE NEGOTIATIONS CULMINATED IN AN IMPORTANT AND PRECEDENT-SETTING INTERNATIONAL AGREEMENT.

IT WAS HAILED AS "A TRIUMPH OF REASON" BY CHRIS PATTEN, BRITAIN'S SECRETARY OF STATE FOR THE ENVIRONMENT.

TODAY'S HEARING, THE FIRST OF TWO HEARINGS ON CONTROL MEASURES AND TECHNOLOGY TRANSFER FOR REDUCING EMISSIONS OF OZONE-DEPLETING SUBSTANCES, IS MEANT TO BE A STRAIGHTFORWARD AND CANDID REVIEW OF THE NEGOTIATIONS THAT LED TO THIS IMPORTANT -- AND IF I MAY SAY IT, PRECEDENT-SETTING -- AGREEMENT.

I LOOK FORWARD TO HEARING FROM THE U.S. DELEGATION REPRESENTED ON THE FIRST PANEL NOT ONLY ABOUT THE OUTCOME OF THE NEGOTIATIONS, BUT ALSO THE INSIDER'S VIEW OF THE PROCESS THAT LED TO AGREEMENT.

I EXPECT THERE WILL BE MANY MORE OF THESE INTERNATIONAL SESSIONS IN THE COMING YEARS, AND INSIGHT INTO THE ATTITUDES AND THOUGHT PROCESSES OF OTHER NATIONS, ESPECIALLY THE DEVELOPING NATIONS, AS THEY PROGRESS WILL BE VERY USEFUL FOR CRAFTING OTHER INTERNATIONAL ENVIRONMENTAL AGREEMENTS.

THE SUBCOMMITTEES ALSO LOOK FORWARD TO HEARING THE PERSPECTIVE OF A WELL-KNOWN AND HIGHLY RESPECTED ENVIRONMENTAL ORGANIZATION, FRIENDS OF THE EARTH INTERNATIONAL, ON THE AGREEEMENT REACHED.

UNDERSTANDING THE ROLE OF INDUSTRY AND ITS VIEWPOINTS, REPRESENTED HERE TODAY BY WITNESSES FROM TWO DIFFERENT "UMBRELLA" ORGANIZATIONS, WILL BE CRUCIAL IF WE ARE TO SUCCESSFULLY IMPLEMENT THE CONTROL MEASURES TO WHICH WE HAVE NOW AGREED.

I WELCOME THE WITNESSES TODAY AND LOOK FORWARD TO THEIR TESTIMONY.

STATEMENT FOR THE RECORD BY CONGRESSMAN RALPH M. HALL

"CFC REDUCTION -- TECHNOLOGY TRANSFER TO THE DEVELOPING WORLD"

JULY 11, 1990

I am delighted that the Subcommittee on International Scientific Cooperation and the Subcommittee on Natural Resources, Agriculture Research, and Environment are co-convened today in a review of a critical issue -- the protection and restoration of our planet's vital stratospheric ozone layer. I gladly yield the gavel to the Chairman of the Natural Resources Subcommittee, the Honorable James H. Scheuer of the great state of New York.

As Chairman of the Subcommittee on International Scientific Cooperation, my concerns today are twofold: first, to assess the progress, internationally, in planning for the transfer of ozone-safe technologies from the "haves" to the "have-nots" of the world community. Second, to register our Subcommittee's early concern that the process of international technology transfer be one which creates global market opportunities -- in the sense that those corporations and institutions which develop substitutes for ozone depleting chemicals and processes receive fair compensation in return for their investments.

Today's panels of witnesses include several delegation members and observers who participated in last week's meeting in London. The meeting was formally called the Second Meeting of the Parties to the

Montreal Protocol on Substances that Deplete the Ozone Layer. I want to commend those participants for a job well done. This nation and the entire world will be better off tomorrow for the cooperation and results achieved in London.

It is my hope that this recent success in London foreshadows continued progress in attacking global environmental problems at the international level. Surely the experience of the past week will benefit those who, in the near future, will strive to develop a protocol for managing the production of the so-called "greenhouse gases".

If the events in London had been merely a political success, I would be less enthused. But the achievement is more -- it is a scientific success, an economic success, and a political success. The newly amended Montreal Protocol is a scientific success because scientists from around the globe developed the physical evidence about ozone depletion and the range of potential solutions over many years -- and effectively communicated their recommendations to policy makers.

The Protocol is an economic success because incentives have been created -- at least in concept -- to bring on-board nations such as China and India, which are economically disadvantaged in today's world. And finally the recent agreement in London is a political success, as an endeavor which builds a consensus and clear direction among ninety-two nations.

Mr. Scheuer. Let's get started with the first panel. Let's go from right to left.

The first witness will be Mr. Richard Smith, Acting Deputy Assistant secretary of Environment, Health and Natural Resources, for the Department of State. Let me say that for all of you we will be limiting our testimony to five minutes, and of course all of your prepared remarks will be included in the record at the point at which you speak. Okay?

So try to speak informally. We are sharing a living room. Sum up your testimony, hit the high points. As it moves on, don't hesitate to refer to anything you have heard before from a witness or from any of the members.

Mr. Packard. Mr. Chairman, I would like to ask unanimous consent that any opening statements that have been prepared may be submitted for the record.

Mr. Scheuer. If anybody has any statements, we can take a brief statement.

Mr. Boehlert. Mr. Chairman, I have a statement, but I would rather hear from the distinguished panel.

Mr. Scheuer. I would accept that unanimous consent, there being no objections.

Okay, we will go ahead with the witnesses.

Let me first introduce my colleagues. Congressman David Skaggs of Colorado, Congressman Ron Packard of California, and Congressman Boehlert of the State of New York.

Please proceed with your five minute testimonies.

STATEMENT OF RICHARD J. SMITH, ACTING DEPUTY ASSISTANT SECRETARY, ENVIRONMENT, HEALTH AND NATURAL RESOURCES, DEPARTMENT OF STATE; ACCOMPANIED BY: EILEEN CLAUSSEN, DIRECTOR, OFFICE OF ATMOSPHERIC AND INDOOR AIR PROGRAMS, ENVIRONMENTAL PROTECTION AGENCY; ROBERT REINSTEIN, DIRECTOR, ENERGY AND NATURAL RESOURCE TRADE POLICY, OFFICE OF THE U.S. TRADE REPRESENTATIVE; AND ROBERT T. WATSON, CHIEF, UPPER ATMOSPHERE/RESEARCH/TROPOSPHERIC CHEMISTRY BRANCH, OFFICE OF SPACE SCIENCE AND APPLICATIONS, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

Mr. Smith. Thank you, Mr. Chairman and members of the subcommittees. I very much appreciate this opportunity to testify on the implementation of the Montreal Protocol and substances that deplete the ozone layer, and in particular to report on the results of the recent London meeting of the parties to the Protocol. The meeting was attended by 93 countries, 59 of which are parties.

I am particularly pleased to be able to tell you that we achieved a major advance in London toward achievement of our common goal of protecting and preserving the stratospheric ozone layer. In the course of doing so, we demonstrated once again the flexibility and vitality of the Montreal Protocol, the truly historic agreement involving unprecedented international cooperation to protect a vital global environmental resource.

Further, and importantly, this remarkable result was achieved with the United States, a recognized leader in the negotiation of the Protocol, continuing to play a positive and highly constructive role. Before turning to the London meeting, I would like to very briefly describe the steps that led up to it. For that purpose, I have provided a chart which illustrates the process we used to progress from the first meeting of the parties to the Montreal Protocol to their second meeting in June of 1990.

Article 6 of the Protocol anticipated the need to make adjustments based on new developments. It directs the parties to assess the control measures of the Protocol based on available scientific, technical and economic information, at least every four years beginning in 1990. That article also directs the parties to convene panels of experts qualified in these fields at least one year before each assessment.

At their first meeting of the parties in Helsinki, four panels were established, which are listed on the chart. The parties also established working groups to make recommendations regarding further control measures and to consider financial and other mechanisms which could assist developing countries to implement the provisions of the Protocol.

The Assessments working group integrated the four panel reports, and prepared a package of amendments for circulation to the parties in preparation for the 1990 meeting. The package contained proposed adjustments to the timing and amount of controls on the five CFCs and three halons already controlled, as well as proposals for including other substances and for strengthening the Protocol's trade, technical and financial assistance programs.

Let me now review for you what was accomplished in London. The Protocol, as negotiated in 1987, envisioned a 50 percent phase-out of CFCs by the year 2000. The second meeting of parties voted to adjust the existing control requirements in the following manner: CFCs were to be reduced by 20 percent in 1993, 50 percent in 1995, 85 percent in 1997, and phased out in the year 2000.

A study to be completed in 1992 will assess the feasibility of accelerating the reduction schedule even further. Halons are to be reduced by 50 percent by 1995, and a phase-out, except for essential uses, is to occur by 2000. By decision, the parties voted to establish an ad hoc technical group to report back to them by 1992, concerning the identification of essential uses.

These adjustments are binding on all parties, and will become effective in six months. In addition, the following amendments to the Protocol were also adopted. Other CFCs— and here I refer to CFCs where there are very small amounts produced, that were not dealt with in 1987, but now are dealt with to assure that any loopholes are closed, and that there won't be an expansion of the use of these CFCs. These other CFCs are also to be reduced by 20 percent in 1993, 85 percent by 1997, and phased out in 2000.

Carbon tetrachloride was added to the list of controlled substances to be reduced by 85 percent by 1995, and phased out by 2000. Methyl chloroform production is to be frozen in 1993, reduced by 30 percent in 1995, 70 percent in 2000, and phased out in 2005.

The parties also adopted amendments on financial and technical assistance to developing countries. These provisions included establishing a financial mechanism to meet the agreed incremental costs incurred by Article 5 parties, and to finance clearinghouse functions, for example, country studies and information dissemination, and establishing an executive committee of the parties to oversee and monitor implementation of the fund, which will be a key element of this overall financial mechanism.

The executive committee will consist of seven members from Article 5 parties i.e. of developing countries, and seven from donor parties. Each group will select its own members. Decisions by the executive committee shall be by consensus, or failing that, by a two-thirds majority including a majority of each group of seven. The multi-lateral fund will perform its functions utilizing the World Bank for financing projects, UNEP for operating the technical clearinghouse, and UNDP for performing pre-investment studies.

The fund will be financed by voluntary contributions from non-Article 5 parties based on the United Nations' assessment scale. Thus, the United States' contribution will be 25 percent of the total. For the first three year period, that total is expected to be in the range of $160 to $240 million, depending on which additional developing countries become parties to the Protocol during that period.

Bilateral assistance can constitute up to 20 percent of a party's contribution to the fund. The United States was designated by the donor group as being by itself one of the seven "groups" from which its seven representatives on the executive committee will be drawn. As a result, the United States can anticipate always having a seat on the committee.

The amendment specifically states that the financial mechanism is "without prejudice to any future arrangements with respect to other environmental issues." New language was also added to the preamble of the Protocol. In the paragraph acknowledging the special needs of developing countries, there is also a recognition that financial and technical assistance is appropriate in this case because the problem is scientifically established, the magnitude of the funds necessary is predictable, and the funding will contribute clearly, directly to the world's ability to address the problem.

In addition to the amendment establishing the financial mechanism, the decision was also taken to establish an interim financial mechanism to operate from 1991 to 1994, so that the implementation of the agreed financial mechanism may begin promptly. A new article was adopted on transfer of technology, calling upon each party to take every practicable step to ensure that the best available technology for producing substitutes for the controlled substances is expeditiously transferred to the Article 5 countries. Such language recognizes that for many countries, relevant technologies and substitutes are not owned by the government.

The parties also adopted amendments to Article 5 on the special situations of developing countries, recognizing the relationship between the effective implementation of the amendments on financial and technical assistance, and the developing country's ability to meet the control measure obligations.

Further, the amendment sets up a review procedure to operationalize and constrain their approach on this issue. If an Article 5 party, having taken all practicable steps, considers it is nevertheless unable to implement any or all of the control measure obligations, it may bring its case to the next meeting of the parties. At that meeting, the parties are to decide upon appropriate action. Between the time the party notifies of its situation in and the meeting of the parties, which cannot exceed one year since the parties meet annually, the non-compliance procedures would not be invoked against that party.

The meeting also adopted non-binding resolutions in the following areas, with regard to other halons, calling on parties to refrain from producing other halons not now regulated by the Protocol, if they would pose a threat to the ozone layer, then on transitional substances, calling on parties to use HCFCs only where other alternatives are not available, and to phase out these chemicals by no later than 2040, and if possible not later than 2020.

Importantly, at the close of the meeting, India and China made statements expressing satisfaction with what had been achieved, and indicating their delegations would be recommending to their governments that they become parties to the Protocol. This follows the joining of the Protocol by Brazil this past spring.

The adherence to the agreement of such major developing countries is a development that is of critical importance to the ultimate success of the Protocol, since without their participation, nothing the rest of us could do would assure the long-term preservation of the ozone layer.

Prior to the opening of the working group session, which preceded the meeting of the parties, the United States made clear that it was prepared, under appropriate conditions, to join a developing consensus that parties should contribute additional resources to a fund to assist developing countries meet their obligations under the Protocol, notwithstanding our earlier expressed view that those resources could be found within funds already made available to the World Bank.

Our statement was warmly welcomed by the other parties to the Protocol and our active participation in this regard was, in my view, a key factor in the successful outcome of the London meeting.

I believe we have passed a watershed on this issue, through provisions on the financial and technological assistance on the one hand, and trade measures on the other hand. We have set up a pattern of incentives and disincentives that I am convinced will lead to the expeditious phasing out of substances that deplete the ozone layer. The active involvement in the process of non-governmental organizations, including representatives of the business community, has been heartening.

It is important that we are taking action on the basis of a broad, international consensus, both in terms of getting the job done, and in being able to assure United States businesses that they will be on a level playing field with respect to their international competitors.

I know my colleagues and I all feel privileged to have been part of this remarkable international effort to face up to and effectively deal with the global environmental threat posed by chemicals which deplete the ozone layer. We welcome this opportunity to talk about it. We are pleased to answer any questions you may have.

Thank you very much.

[The prepared statement of Mr. Smith follows:]

TESTIMONY BY RICHARD J. SMITH
ACTING DEPUTY ASSISTANT SECRETARY
ENVIRONMENT, HEALTH AND NATURAL RESOURCES

BUREAU OF OCEANS AND INTERNATIONAL
ENVIRONMENTAL AND SCIENTIFIC AFFAIRS

BEFORE THE

HOUSE SUBCOMMITTEE ON
INTERNATIONAL SCIENTIFIC COOPERATION
AND THE
HOUSE SUBCOMMITTEE ON
NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

JULY 11, 1990

MR. CHAIRMAN, MEMBERS OF THE SUBCOMMITTEES, I VERY MUCH APPRECIATE THIS OPPORTUNITY TO TESTIFY ON THE IMPLEMENTATION OF THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER AND, IN PARTICULAR, TO REPORT ON THE RESULTS OF THE RECENT LONDON MEETING OF THE PARTIES TO THE PROTOCOL WHICH WAS ATTENDED BY 93 COUNTRIES, 59 OF WHICH ARE PARTIES.

I AM PLEASED TO BE ABLE TO TELL YOU THAT WE ACHIEVED A MAJOR ADVANCE IN LONDON TOWARD THE ACHIEVEMENT OF OUR COMMON GOAL OF PROTECTING AND PRESERVING THE STRATOSPHERIC OZONE LAYER. IN THE COURSE OF DOING SO, WE DEMONSTRATED ONCE AGAIN THE FLEXIBILITY AND VITALITY OF THE MONTREAL PROTOCOL, A TRULY HISTORIC AGREEMENT INVOLVING UNPRECEDENTED INTERNATIONAL COOPERATION TO PROTECT A VITAL GLOBAL ENVIRONMENTAL RESOURCE. FURTHER, THIS REMARKABLE RESULT WAS ACHIEVED WITH THE UNITED STATES, A RECOGNIZED LEADER IN NEGOTIATION OF THE PROTOCOL, CONTINUING TO PLAY A POSITIVE AND HIGHLY CONSTRUCTIVE ROLE.

LET ME REVIEW FOR YOU WHAT WAS ACCOMPLISHED IN LONDON.

THE PROTOCOL AS NEGOTIATED IN 1987 ENVISIONED A 50 PERCENT PHASE-OUT OF CFCS BY THE YEAR 2000. THE SECOND MEETING OF THE PARTIES VOTED TO "ADJUST" THE EXISTING CONTROL REQUIREMENTS IN THE FOLLOWING MANNER:

A. CFCS TO BE REDUCED BY 20 PERCENT IN 1993, 50 PERCENT IN 1995, 85 PERCENT IN 1997 AND PHASED OUT IN 2000. A STUDY TO BE COMPLETED IN 1992 WILL ASSESS THE FEASIBILITY OF ACCELERATING THE REDUCTION SCHEDULE.

B. HALONS ARE TO BE REDUCED BY 50 PERCENT BY 1995 WITH A PHASE-OUT (EXCEPT FOR ESSENTIAL USES) TO OCCUR BY 2000. BY DECISION, THE PARTIES VOTED TO ESTABLISH AN AD HOC TECHNICAL GROUP TO REPORT BACK TO THEM BY 1992 CONCERNING THE IDENTIFICATION OF ESSENTIAL USES.

THESE ADJUSTMENTS ARE BINDING ON ALL PARTIES AND WILL BECOME EFFECTIVE IN SIX MONTHS.

THE FOLLOWING AMENDMENTS TO THE PROTOCOL WERE ALSO ADOPTED:

A. OTHER CFCS: TO BE REDUCED BY 20 PERCENT IN 1993, 85 PERCENT IN 1997 AND PHASED OUT IN 2000.

B. CARBON TETRACHLORIDE: TO BE REDUCED BY 85 PERCENT BY 1995 AND PHASED OUT BY 2000.

C. METHYL CHLOROFORM: TO BE FROZEN IN 1993, REDUCED BY 30 PERCENT IN 1995, AND 70 PERCENT IN 2000, AND PHASED OUT IN 2005.

THE PARTIES ALSO ADOPTED AMENDMENTS ON FINANCIAL AND TECHNICAL ASSISTANCE TO DEVELOPING COUNTRIES. THESE PROVISIONS INCLUDED:

A. ESTABLISHING A FINANCIAL MECHANISM TO:

-- (1) MEET THE AGREED INCREMENTAL COSTS INCURRED BY ARTICLE 5 PARTIES; AND

-- (2) FINANCE CLEARINGHOUSE FUNCTIONS (E.G., COUNTRY STUDIES, INFORMATION DISSEMINATION).

B. ESTABLISHING AN EXECUTIVE COMMITTEE TO OVERSEE AND MONITOR IMPLEMENTATION OF THE FUND WHICH WILL BE A KEY ELEMENT OF THE FINANCIAL MECHANISM. THE EXECUTIVE COMMITTEE WILL CONSIST OF 7 MEMBERS FROM ARTICLE 5 PARTIES AND 7 FROM DONOR PARTIES. EACH GROUP WILL SELECT ITS OWN MEMBERS. DECISIONS BY THE EXECUTIVE COMMITTEE SHALL BE BY CONSENSUS OR FAILING THAT, BY A TWO-THIRDS MAJORITY, INCLUDING A MAJORITY OF EACH GROUP OF SEVEN.

C. THE MULTILATERAL FUND WILL PERFORM ITS FUNCTIONS UTILIZING THE WORLD BANK FOR FINANCING PROJECTS, UNEP FOR OPERATING THE TECHNICAL CLEARINGHOUSE, AND UNDP FOR PERFORMING PRE-INVESTMENT STUDIES.

D. THE FUND WILL BE FINANCED BY VOLUNTARY CONTRIBUTIONS FROM NON-ARTICLE 5 PARTIES BASED ON THE UNITED NATIONS ASSESSMENT SCALE. THUS, THE EXPECTED UNITED STATES CONTRIBUTION WILL BE 25 PERCENT OF THE TOTAL. (FOR THE FIRST 3-YEAR PERIOD THAT TOTAL IS EXPECTED TO BE 160-240 MILLION DOLLARS DEPENDING ON WHICH ADDITIONAL DEVELOPING COUNTRIES BECOME PARTIES TO THE PROTOCOL DURING THAT PERIOD.)

E. BILATERAL ASSISTANCE CAN CONSTITUTE UP TO 20 PERCENT OF A PARTY'S CONTRIBUTION TO THE FUND.

F. THE UNITED STATES WAS DESIGNATED BY THE DONOR GROUP AS BEING ITSELF ONE OF THE SEVEN "GROUPS" FROM WHICH ITS SEVEN REPRESENTATIVES ON THE EXECUTIVE COMMITTEE WILL BE DRAWN. AS A RESULT, THE UNITED STATES CAN ANTICIPATE ALWAYS HAVING A SEAT ON THE COMMITTEE.

G. THE AMENDMENT SPECIFICALLY STATES THAT THE FINANCIAL MECHANISM IS "WITHOUT PREJUDICE TO ANY FUTURE ARRANGEMENTS... WITH RESPECT TO OTHER ENVIRONMENTAL ISSUES."

H. NEW LANGUAGE WAS ALSO ADDED TO THE PREAMBLE OF THE PROTOCOL. IN THE PARAGRAPH ACKNOWLEDGING THE SPECIAL NEEDS OF DEVELOPING COUNTRIES, THERE IS ALSO A RECOGNITION THAT FINANCIAL AND TECHNICAL ASSISTANCE IS APPROPRIATE IN THIS CASE BECAUSE THE PROBLEM IS SCIENTIFICALLY ESTABLISHED, THE MAGNITUDE OF THE FUNDS NECESSARY IS PREDICTABLE, AND FUNDING WILL CONTRIBUTE DIRECTLY TO THE WORLD'S ABILITY TO ADDRESS THE PROBLEM.

I. IN ADDITION TO THE AMENDMENT ESTABLISHING THE FINANCIAL MECHANISM, A DECISION WAS ALSO TAKEN TO ESTABLISH AN INTERIM FINANCIAL MECHANISM TO OPERATE FROM 1991 TO 1994, SO THAT THE IMPLEMENTATION OF THE AGREED FINANCIAL MECHANISM MAY BEGIN PROMPTLY.

A NEW ARTICLE WAS ADOPTED ON TRANSFER OF TECHNOLOGY CALLING UPON EACH PARTY TO TAKE "EVERY PRACTICABLE STEP TO ENSURE" THAT THE BEST AVAILABLE SUBSTITUTES FOR THE CONTROLLED SUBSTANCES ARE EXPEDITIOUSLY TRANSFERRED TO THE ARTICLE 5 PARTIES. SUCH LANGUAGE RECOGNIZES THAT, FOR MANY COUNTRIES, RELEVANT TECHNOLOGIES AND SUBSTITUTES ARE NOT OWNED BY THE GOVERNMENT.

THE PARTIES ALSO ADOPTED AMENDMENTS TO ARTICLE 5 ON THE SPECIAL SITUATIONS OF DEVELOPING COUNTRIES RECOGNIZING THE RELATIONSHIP BETWEEN THE EFFECTIVE IMPLEMENTATION OF THE AMENDMENTS ON FINANCIAL/TECHNICAL ASSISTANCE AND THE DEVELOPING COUNTRIES' ABILITY TO MEET THE CONTROL MEASURE OBLIGATIONS. FURTHER, THE AMENDMENT SETS UP A REVIEW PROCEDURE TO OPERATIONALIZE AND CONSTRAIN OUR APPROACH ON THIS ISSUE. IF AN ARTICLE 5 PARTY, HAVING TAKEN ALL PRACTICABLE STEPS, CONSIDERS IT IS NEVERTHELESS UNABLE TO IMPLEMENT ANY OR ALL OF THE CONTROL MEASURE OBLIGATIONS, IT MAY BRING ITS CASE TO THE NEXT MEETING OF THE PARTIES. AT THAT MEETING, THE PARTIES ARE TO DECIDE UPON APPROPRIATE ACTION. BETWEEN THE TIME THE PARTY NOTIFIES OF ITS SITUATION AND THE MEETING OF THE PARTIES (WHICH WOULD NOT EXCEED A YEAR), THE NON-COMPLIANCE PROCEDURES WOULD NOT BE INVOKED AGAINST THAT PARTY.

THE MEETING ALSO ADOPTED NON-BINDING RESOLUTIONS IN THE FOLLOWING AREAS:

A. OTHER HALONS:

-- CALLING ON PARTIES TO REFRAIN FROM PRODUCING OTHER HALONS NOT NOW REGULATED BY THE PROTOCOL IF THEY WOULD POSE A THREAT TO THE OZONE LAYER.

B. TRANSITIONAL SUBSTANCES:

-- CALLING ON PARTIES TO USE HCFCS ONLY WHERE OTHER ALTERNATIVES ARE NOT AVAILABLE AND TO PHASE OUT THESE CHEMICALS BY NO LATER THAN 2040 AND IF POSSIBLE, NOT LATER THAN 2020.

IMPORTANTLY, AT THE CLOSE OF THE MEETING, INDIA AND CHINA MADE STATEMENTS EXPRESSING SATISFACTION WITH WHAT HAD BEEN ACHIEVED AND INDICATING THAT THEIR DELEGATIONS WOULD BE RECOMMENDING TO THEIR GOVERNMENTS THAT THEY BECOME PARTIES TO THE PROTOCOL. THIS FOLLOWS THE JOINING OF THE PROTOCOL BY BRAZIL THIS PAST SPRING. THE ADHERENCE TO THE AGREEMENT OF SUCH MAJOR DEVELOPING COUNTRIES IS A DEVELOPMENT THAT IS OF CRITICAL IMPORTANCE TO THE ULTIMATE SUCCESS OF THE PROTOCOL, SINCE WITHOUT THEIR PARTICIPATION, NOTHING THE REST OF US COULD DO COULD ASSURE THE LONG TERM PRESERVATION OF THE OZONE LAYER.

PRIOR TO THE OPENING OF THE WORKING GROUP SESSION WHICH PRECEDED THE MEETING OF THE PARTIES, THE UNITED STATES MADE CLEAR THAT IT WAS PREPARED UNDER APPROPRIATE CONDITIONS TO JOIN A DEVELOPING CONSENSUS THAT PARTIES SHOULD CONTRIBUTE ADDITIONAL RESOURCES TO A FUND TO ASSIST DEVELOPING COUNTRIES MEET THEIR OBLIGATIONS UNDER THE PROTOCOL, NOTWITHSTANDING OUR

EARLIER EXPRESSED VIEW THAT THOSE RESOURCES COULD BE FOUND WITHIN THE FUNDS ALREADY MADE AVAILABLE TO THE WORLD BANK. OUR STATEMENT WAS WARMLY WELCOMED BY THE OTHER PARTIES TO THE PROTOCOL AND OUR ACTIVE PARTICIPATION IN THIS REGARD WAS A KEY FACTOR IN THE SUCCESSFUL OUTCOME OF THE LONDON MEETING.

I BELIEVE WE HAVE PASSED A WATERSHED ON THIS ISSUE. THROUGH THE PROVISIONS ON FINANCIAL AND TECHNOLOGICAL ASSISTANCE ON THE ONE HAND AND TRADE MEASURES ON THE OTHER, WE HAVE SET UP A PATTERN OF INCENTIVES AND DISINCENTIVES THAT I AM CONVINCED WILL LEAD TO THE EXPEDITIOUS PHASING OUT OF SUBSTANCES THAT DEPLETE THE OZONE LAYER. THE ACTIVE INVOLVEMENT IN THE PROCESS OF NON-GOVERNMENTAL ORGANIZATIONS, INCLUDING REPRESENTATIVES OF THE BUSINESS COMMUNITY, HAS BEEN HEARTENING. IT IS IMPORTANT THAT WE ARE TAKING ACTION ON THE BASIS OF A BROAD INTERNATIONAL CONSENSUS BOTH IN TERMS OF GETTING THE JOB DONE AND IN BEING ABLE TO ASSURE UNITED STATES BUSINESSES THAT THEY WILL BE ON A LEVEL PLAYING FIELD WITH RESPECT TO THEIR INTERNATIONAL COMPETITORS.

I KNOW MY COLLEAGUES AND I ALL FEEL PRIVILEGED TO HAVE BEEN PART OF THIS REMARKABLE INTERNATIONAL EFFORT TO FACE UP TO AND EFFECTIVELY DEAL WITH THE GLOBAL ENVIRONMENTAL THREAT POSED BY CHEMICALS WHICH DEPLETE THE OZONE LAYER, AND WE WELCOME THIS OPPORTUNITY TO TALK ABOUT IT. WE WOULD BE PLEASED TO ANSWER ANY QUESTIONS YOU MAY HAVE.

THANK YOU MR. CHAIRMAN.

Mr. SKAGGS. Thank you, Mr. Smith. As you probably noticed, our chairman has departed. He will be back after a brief absence, having to do with the selection of a site for the Democratic National Convention, as I understand it, hopefully an event that will not produce many CFCs in New York.

Let me open up with a couple of questions. The divergence of the amounts of money that you mentioned to be used for assisting the article 5 countries, somewhere between $160 million and $240 million, I assume that reflects the increment that would occur if India and China ratify the Protocol.

Mr. SMITH. That's correct.

Mr. SKAGGS. What about the implications of other nations joining in, and the money significance of that coming about?

Mr. SMITH. With India and China joining, we would have had the major countries where the potential for large increases might occur, and where large expenditures may be needed. I think it is fair to say that, although some of my colleagues may have another idea, the other countries are in that sense, much less important. Obviously, we are going to make a major effort to make this a very comprehensive agreement that has most if not all of the countries in the world adhering to it.

But the financial implications of any other countries joining would not be on that order of magnitude, so we would not anticipate going beyond the $240 million figure over that first three-year period.

Mr. SKAGGS. Can you give me a better feel for how the enforcement mechanisms that are put in place would actually work in practice, if a signatory, if you will, decided to cheat?

Mr. SMITH. On this, Mr. Reinstein from USTR, who has worked very directly with some of the trade measures, might want to add to my answer. Basically, you have both a carrot and a stick, in a sense. If the parties are not meeting their commitments, that will jeopardize their ability to receive the assistance that would be available through the financial mechanisms on the carrot side.

On the stick side, there are some very significant trade implications for a country that puts itself in that position, and maybe Mr. Reinstein, if you are interested in pursuing those trade issues—

Mr. SKAGGS. I also have a question. How do you know? What's the verification mechanism?

Mr. SMITH. There is a non-compliance committee which will be meeting and looking at that very question.

Mr. REINSTEIN. In London, we did adopt a series of compliance procedures as an annex to the Protocol. They provide for a mechanism of consultation and conciliation among the parties. There is, as one possible outcome of that process, failing resolution of a difficulty with a party which is not complying, that they could be subject, in principle, to the trade restrictions which are applied to non-parties. The trade restrictions are contained in Article 4 of the Protocol, and they provide some significant disincentives to countries to remain outside the Protocol.

Mr. SKAGGS. Mr. Smith, and anyone else who might care to comment, there was certainly a perception, at least for a while, that the United States' position on this was by comparison a somewhat reluctant one, relative to the level of aggressiveness and willingness to move quickly, shown by some of our European friends.

What was the political climate, the international perception, of the United States position at the conclusion of the London talks? How do we stand with our neighbors on this issue now?

Mr. SMITH. I will start, and then ask someone else to add. I think the perception was very positive, and I think indeed, correctly perceived that the United States has throughout this process been a leader, and been very actively involved in creating the consensus that we achieved in London.

Ms. CLAUSSEN. I think we can be a little more specific. It was the United States that put on the table the additional ozone depleting chemicals, carbon tetrachloride and methyl chloroform, last year in Helsinki that really came from the United States.

It is the United States that has done a great deal of the work on the technology assessments, and I think our perception of general leadership was pretty well recognized, even though we may not have gone with the 1997 phase-out date, which I think is impractical and impossible to do.

Mr. SKAGGS. Our credit in the international community is in good shape on this?

Ms. CLAUSSEN. I think so.

Mr. SKAGGS. Let me turn to my colleagues Ron Packard from California, who is the ranking member on the International subcommittee.

Mr. PACKARD. Mr. Chairman, I think before I get into my questions, I would like to hear—are we not to hear from the rest of the panel?

Mr. SKAGGS. Oh, I'm sorry. There were no other prepared statements, so that's the reason I am proceeding to questions.

Mr. PACKARD. I would like to then pursue the question on trade, itself. I would like to know specifically how this will affect our existing trade, and how that transition will take place under the agreement that will alter some of our trade activities, and so forth.

I would appreciate it if there could be some clarification as to how much of the existing non-conforming products are now being exported from the United States, and how those companies will make a transition to conformance.

Mr. REINSTEIN. Let me distinguish between trade in the chemicals themselves and trade in products which may contain them or be manufactured using them, but not actually contain them.

With respect to the chemicals themselves, trade among the parties to the Protocol is completely free. That is, it is not interfered with at all, but it is calculated into the formula for emissions. That is to say, the Protocol controls consumption as measured by production plus imports minus exports.

So by including trade explicitly in the formula, it allows the available supply, which is constrained overall among parties, to be distributed among the parties through free trade.

With respect to non-parties, under the amendments adopted in London, both imports to and exports from non-parties will be banned. With respect to the products which may contain the chemicals, the Protocol requires the elaboration of a list of certain of these products by 1992, and anticipates that parties would adopt this list as an annex, and those adopting it would ban imports of those products. This could include air conditioners or things like that, if they are charged with the CFCs. It could also include certain kinds of foam, foam insulation or other foams that may contain CFCs as a foam-blowing agent, products of that type.

The Protocol further provides for a feasibility study on import restrictions on products that have been made using CFCs, but do not actually contain them. This would include many electronic products. That feasibility study is to be completed by 1994, I believe. At this point, the trade is not being interfered with to a great extent. We have no evidence at this point that parties outside the Protocol are benefitting significantly from a commercial point of view by the current lack of those trade restrictions on products containing or using them.

That would certainly be a factor as we go through the elaboration of the list and feasibility studies, but at this point, we have no evidence that United States companies have suffered adverse competitiveness effects due to the Protocol.

Mr. PACKARD. Thank you.

Mr. Smith, how is the distribution of the funds to be handled? And what are the criteria that would determine which countries would get financing? I would be interested in an evaluation of the financing mechanism.

Mr. SMITH. Let me start again, I think others may want to add other aspects to it. Basically, the executive committee of the parties, this 14-member committee which was set up and the members named in London, and in fact had their first meeting after the meeting itself ended in London, they will be responsible for monitoring and overseeing this process.

For example, they will decide where the account will be that the checks will go to, they will decide on the basis of the guidelines that the parties have set up on transfers of the money to the World Bank, if indeed they agree to play the role we have envisioned for them, and to the UNDP, and to the UNEP clearinghouse operation. Then they will meet regularly with these organizations to oversee the use of the funds, and, in the case of large outlays by the World Bank, of $500,000 or more, they will in fact look for prior approval of those outlays.

As to what it will be spent on, the parties did themselves come up with an indicative list of the kinds of things it might be spent on. For example, the additional cost, if a country was going to produce CFCs, but shifted to a CFC substitute, and it was going to cost a certain amount more to produce that substitute, with no clear return for that additional expenditure, that would be an incremental expense that might be covered by a grant, for example, from this fund.

We have a list of such indicative incremental costs, but the operational aspect will be that this committee will be responsible for watching very carefully what is done, and reporting back to the parties at their annual meetings, and providing the guidance and oversight that is needed.

Mr. PACKARD. Will most of the funding be by grants, or will they be by loans? And will the United States have access — almost proportionate access—to those funds as much as third world countries?

Ms. **Claussen**. I will try to take a crack at that. I think the general sense is that most of these will be grants rather than loans. We will probably use loans where the paybacks would be enough, for example, if you are doing an aerosol from CFCs to hydrocarbons, that will, in the end, make a profit. In that kind of case, we would do a loan rather than a grant. Now if we were talking about refurbishing our refrigerator plant, it is a straight cost, and we would probably talk about doing a grant there, rather than a loan.

So there is some flexibility on how this would be done based on the economic conditions of the particular project.

Mr. **Smith**. On the other part of your question, which is the access to this business by U.S. firms, it will be market-based, as I understand how the market will function, I would anticipate U.S. firms will do very well in that market. They have been represented regularly at the meetings, and have been leaders in finding substitutes. So I would anticipate that in the play of the market, U.S. firms will certainly take a substantial share of this new activity.

Mr. **Packard**. Has there been sufficient testing, and is there sufficient verification that the replacements in another 10 or 15 or 20 years will not create the same kinds of problems? We struggled with the fluorocarbons.

Ms. **Claussen**. We had EPA look quite a bit at the substitutes. We clearly have responsibility under the Toxic Substances Control Act to make sure that they are not toxic, and we are exercising that responsibility. We are also concerned with the energy efficiency of some of the substitutes, because some of them may be less energy efficient. Some of them are also ozone depleters, although at a much lower level than the CFCs, and in that case, we clearly have a commitment to phase out those chemicals as well.

So I think it is fair to say that we are taking a very close look at all that, and making sure that what we come up with is reasonable.

Mr. **Packard**. Thank you.

Mr. **Skaggs**. Let me call on Mr. Boehlert, who is the ranking member of the Resources subcommittee.

Mr. **Boehlert**. Thank you, Mr. Chairman. As the co- author of the CFC amendment that passed the House, I have more than a casual interest in this. I would like to point out that my colleagues in the House had the good judgment to pass our amendment unanimously. As I look at the comparison between the Bates-Boehlert Amendment and what we agreed to in London, I notice very distinct similarities, and I am pleased with that.

I would agree with you, Mr. Smith, that we have passed a watershed on this issue. One of the frustrations I experience is that we don't get enough credit for the leadership we are providing. This comes, incidentally, from someone who has a League of Conservation voting record of 100 percent. The last time I checked, you can't get any better than that. So my friends, the Friends of the Earth and all those other organizations, know of my record.

But the frustration I have experienced is that the media seems to pay too much attention to what Governor Sununu or Budget Director Darman say, rather than what President Bush does. In the final analysis, it is not what we say that really counts, it is what we do that counts. I think we have come a long way. It is encouraging to me, and I want you to know that I am not just being a Bush loyalist or cheerleader, although I proudly identify with both categories—

Mr. SKAGGS. We are not talking about taxes.

Mr. BOEHLERT. Read my lips, Mr. Chairman. We have come a long way. It is nice to have in the White House, in the Oval Office, an environmental president. But, having given all those accolades—and I think they are well deserved—let's get right to the nub of the problem.

I am looking at the testimony that is going to come from Liz Cook, of the Friends of the Earth. My friends in the Friends of the Earth have three basic complaints. One, they say the agreement includes dangerously slow timetables for the phase-out. A lot of people, 13 nations, as I understand it, wanted 1997. We seem to hold out for the year 2000. So I would like to address that, then we'll go to something else.

Let's talk about the timetable. Why is 2000 adequate when there appears to be all the scientific data we need to lead us to conclude that 1997 would be better? Look at—

Mr. SMITH. Again, let me just start out. I have a few points to make on this, I have been very deeply involved in these discussions for a very long time.

I would say that—well, I agree with your first point, we don't get adequate credit for what we do, and we often get blamed for things we don't do. But we were not isolated in the position that it had to be 2000. There was a lot of support for that position.

As a negotiator, I would say that by the time we reached the London meeting, having worked as this chart shows, a long time in the series of meetings to achieve the consensus of around 2000, to have suddenly sought to revert to a 1997 approach would have been very unsettling, not just to us, but to a number of other countries, which would have had to restructure their approach.

I think that we would have had our friends in the business community, who have worked very closely in achieving with us what I think we did achieve, wonder when they really had something they could depend on. I think from that point of view, I expect we will beat the 2000 deadline. Clearly we are ahead of schedule now, as are most other countries. But I think to have moved back from that at the last minute in London would have been a mistake, and would have affected the goodwill that we had with the other partners in this enterprise.

Mr. BOEHLERT. That's the political aspect. Let's look at the science of it. What happens if we wait until 2000 versus 1997? Where are we at risk?

Mr. WATSON. The way the Montreal Protocol is now constructed is that there is an agreement for an 85 percent cutback by 1997, and a full phase-out in the year 2000. That means there will only be a three year period where we are using 15 percent of today's levels. That would mean it would add about 0.05 parts per billion of chlorine to the atmosphere.

To put that in perspective, we have about 3.5 parts per billion of chlorine in the atmosphere today, by the year 2000 we would expect something about 4 or 4.5 parts per billion. So we are talking about a very small difference, 0.05 parts per billion. A quick calculation would say that would slow down the recovery of the Antarctic ozone hole at most by one to two years.

The Antarctic hole would not recover even with this highly modified Montreal Protocol until somewhere between the year 2050 and 2070; its hard to be precise. It would add one or two years to the recovery. So basically the extra three years at 15 percent of today's production really is a very small amount of loading to the chlorine to the atmosphere.

Mr. BOEHLERT. Thank you, Dr. Watson. You are a scientist, and it is important to get some scientific input here. I might add, parenthetically, that when scientists agree with the position I have stated I applaud them, and when they don't, I think they are wrong. That's the way we operate on Capitol Hill.

But there is some opportunity, I would assume, between now and 1995, to reassess the situation because the science is really moving forward very rapidly. And that's encouraging for all of us who are concerned about the quality of our environment. So, there is an option of accelerating the schedule.

Ms. CLAUSSEN. Yes. We have a reassessment due in 1992 to see if we can move up the schedule. For those who think it can be done by 1997, I guess I would like to see the reassessment. The one that was done last year thought that 2000 was feasible, but could not identify alternatives for all the uses that exist even now.

Mr. BOEHLERT. Let me ask another question. We are not dealing with HCFCs until the year 2040. Good Gosh, I doubt if many of us will be here then. Why then?

Ms. CLAUSSEN. Again, this is a two-part question, and maybe Bob can answer the science part, and I can answer the technology part.

Mr. SMITH. And I'll do the politics.

Mr. WATSON. Let me address it from a scientific perspective. I think there are three goals for protecting stratospheric ozone. One is minimizing the peak chlorine loading. That is really governed by what we do with the long- lived CFCs. But afterward there are two issues.

One is how quickly can we reduce the atmospheric levels of chlorine to two parts per billion, which is what we believe we must reduce the chlorine levels to, to get rid of the Antarctic ozone hole. The second issue is how quickly can we reduce the peak chlorine loading in the atmosphere. And that primarily has to do with the amount of global ozone depletion we might anticipate, and also the possibility of an ozone hole over the Arctic coming about.

It is clear to me that we will need to have some type of regulations eventually on the HCFCs. What we should be trying to do is encourage industry to go to the shortest lived HCFCs, the ones with one, two or five-year lifetimes, not the ones with 15 to 20-year lifetimes.

Now what regulations might be needed to safeguard the ozone layer? If we were only focusing on getting rid of the Antarctic ozone hole, there is a very simple formula. You basically have to eliminate the HCFC production and emissions, what we call two lifetimes (twice the atmospheric lifetime of the gas) before about

2050, or 2070. So you need somewhere in the time period of 2020 to 2040 to phase out those gases, based on their lifetime.

I think we need to do a little more research to find out exactly what the lifetimes of these gases are, and what their degradation products are. Then I think within a two to five year period there needs to be national and international regulations to decide what the right time would be to phase out the HCFCs. It is essential that at some stage they are phased out, otherwise you will never get rid of the Antarctic ozone hole.

We should also be encouraging industry to go to the short-lived HCFCs, because they are the gases that would help bring the peak chlorine loading down quickest. How to go about that in a regulatory sense, that is clearly for the politicians to look at. So I think the point to note is that there will need to be a simple resolution, there will need to be firm national and international regulations.

I believe those drop-dead dates, the time we phase out gases, should, from a scientific perspective, be dependent on their lifetimes. In other words, you might want to phase out a 20 year gas in the year 2020, whereas you may be willing to live with a five or two-year lifetime gas until 2030 or even 2040. So I think there needs to be a good interchange between the science community and the policy/technology communities to try and put this in a very logical framework.

Ms. CLAUSSEN. I think you have to look at it in two other ways as well. First of all, the United States was trying to get an amendment with phase-out dates for the HCFCs which would put us in a more aggressive leadership role, but we were unable to do that, because other countries were not willing to agree to a phase-out date—

Mr. BOEHLERT. That's an important point. Would you pull the microphone a little closer, especially if you are saying something that significant. I want everyone to hear you. But we did—the United States is not happy with 2040.

Ms. CLAUSSEN. The United States would have preferred an amended Protocol with earlier phase-out dates. But we were unable to get a consensus on that point, and the best we could do was a resolution with a range of dates. Again, I think there is no question that we need the HCFCs, and it would be useful to phase them out as soon as we could find better substitutes. Industry has to be working on the next generation of substitutes even now, while they are working on these, because we know that we eventually have to get rid of them.

Mr. BOEHLERT. As a practical matter, in industry they are?

Ms. CLAUSSEN. Yes. I also think that when we come back in 1992 with our next technology assessment, we will have a firmer idea of some of the things that Bob was talking about, and we probably will be able to achieve an amended protocol at that point.

Ms. SMITH. I would just like to add that as I see it, it is a question of balance. On the one hand, this is a transitional substitute. If you phase it out too soon, you will encourage the longer use of CFCs. Whereas, if you give enough of a period so that it becomes attractive for companies to produce at least a generation of HCFCs to get people off CFCs before you eliminate the HCFCs, then you have created a situation that will maximize the kind of result we are trying to achieve.

Mr. BOEHLERT. Mr. Chairman, I could go on all morning on this subject. Let me conclude by once again complimenting our panel for their significant contribution. Mr. Smith, I do agree with your observation that it is a watershed in this issue. If I had my druthers, what I would do is require Budget Director Darman and Governor Sununu to raise their right hand and take a pledge not to speak on environmental issues for 30 days—a moratorium—and let our actions determine what the public will say with respect to activities of the U.S. Government.

I think we are moving in the right direction, finally. This comes from a Republican who admitted that the previous Administration was a disaster on the environment. It is refreshing to have somebody who cares in the Oval Office.

Thank you, Mr. Chairman.

Mr. SKAGGS. Thank you, Mr. Boehlert. I also, for the record, want to correct my introduction of your status as ranking on SRT, not on Natural Resources.

Dr. Watson, I am interested in the implication of one of your earlier answers that we are now in a position with adequate atmospheric modeling and chemistry understanding to basically predict rates of recovery of the ozone layer. I wonder if you would elaborate a little bit on that, and in doing so, perhaps address as well the provisions of the UNEP report dealing with international monitoring approaches and how that will work.

Mr. WATSON. Yes. One thing is very simple, and that is to try and predict when the Antarctic ozone hole will disappear. We know the Antarctic ozone hole first occurred during the early to mid-1970s. We also know, because of atmospheric monitoring, that the levels of chlorine in the atmosphere at that time were about two parts per billion.

So the question is very simply posed, how quickly will the current atmospheric loading of three to three and a half parts per billion of chlorine be reduced back to two parts per billion of chlorine? All you actually have to know to do that calculation is the atmospheric lifetimes of the gases. For the longest-lived CFCs this tends to be between 75 and 150 years. For the short-lived HCFCs, it tends to be between two and 20 years. So it is actually a rather simple calculation, one of the easier ones we can do, and that is to work out the rate of reduction of the chlorine loading in the atmosphere. That fortunately is a fairly easy calculation.

It is much harder to say how the global ozone will recover in such a quantitative sense. But it is quite clear when the chlorine loading gets back to two parts per billion, we can expect at that stage that it will be no threat to the Antarctic ozone hole and it should disappear nor be a threat to the polar ozone in the Northern Hemisphere.

According to monitoring, I think we are in fairly decent shape for some parameters at the moment. W. Cole has a ground-based network called a Dobson network which measures total ozone. NASA and NOAA have continuous satellite monitoring of ozone. So for the monitoring of ozone itself, we are in reasonably good shape. We have finally learned how to calibrate both the ground-based system and the satellite system.

We are fairly confident we can do a reasonable job of monitoring the trends in atmospheric ozone. The key issue here, then, is not only monitoring trends in ozone, but understanding cause and effect. If the trends in ozone change, are they changing due to natural influences or due to human activities?

NASA and NOAA are leading an international effort to put together a program called the Network for the Detection of Stratospheric Change, a ground-based program in which we would like to have somewhere between half a dozen and a dozen stations throughout the world of the most sophisticated monitoring, not only of ozone, but the key chemicals of the chlorine, nitrogen, and hydrogen families. We have started that ball rolling, and we have started to get good international cooperation on that.

We also need to complement that with satellite observations. NASA will complement that with the launch of the Upper Atmospheric Research Satellite (UARS) in 1991 and hopefully the Earth Observing System in the late 1990s will continue that satellite monitoring of ozone and related species.

There is also an international network, led again by NASA and NOAA, to monitor the CFCs. That is why we do understand the distribution of CFCs and their atmospheric lifetime. What we now have to put in place, and it is rather urgent, between the United States and other governments, is a monitoring network for the HCFC's.

As they come on line, we must monitor the atmospheric growth that will not only tell us the trends in the HCFCs, but actually tell us something about their lifetimes. It is understanding those lifetimes that will help us make sure we put the Protocol and new regulations on CFCs into the right perspective.

We have started discussions with other countries and within the United States of how to do such a network, but we have not yet quite designed the network, so we are not quite ready to implement such a network.

So overall, I think there is reasonable coordination on monitoring. I would have to say that the U.S. is clearly the leader in this field. We spend far more money on both understanding the ozone layer and monitoring the ozone layer than most other countries. But there are some good supportive efforts throughout Europe, clearly they are minimal efforts just because of the cost of these types of research efforts in developing countries.

Mr. SKAGGS. Mr. Smith, I guess a question on international law would fall within your bailiwick on the panel. We are not going to have to go through any kind of ratification exercise or are we, on these amendments?

Mr. SMITH. Yes, the amendments will have to be ratified. Not the adjustments. The adjustments, which are changes to products which are already controlled, were envisioned at the time the agreement was ratified, and those can take place without further ratification. But on the question of the amendments, which includes the financial measures and also the new products which are being controlled, that were not controlled in 1987, these will come back to the Senate for advice and consent.

Mr. **Skaggs**. And the time line for that?

Mr. **Smith**. I don't know. As soon as we get the papers ready, we will be coming pretty fast, and then however long the process takes. If I may say on that point, that is the reason why I referred to a decision being taken on the financial mechanism in addition to the amendment, so that that decision can operate temporarily so we don't have to wait for the ratification and can begin the process of getting the money out and getting the job done even before the ratifications are achieved.

Mr. **Skaggs**. Ms. Claussen, we are going to see the United States presumably playing a leading role through our private sector in the development of the technologies and substitute substances that are going to be involved here. Could you speak as to how we are going to proceed—industry-Government partnership—in transferring those technologies, licensing arrangements, that whole range of issues?

Ms. **Claussen**. Let me try to deal with that from a couple points of view. I think one of the things that has characterized this issue are the very good relationships we have had among non-governmental organizations, industry and government. For example, on the issue of technology transfer, we do have in one sector, the electronic sector, something called the International Cooperative on Ozone Layer Protection, which is a group of electronics companies, mostly United States, but some from Canada and from the United Kingdom, working in agreement with us to try to transfer as much technology as possible.

We are working on a series of seven manuals on how, with specific applications, you can reduce and eliminate the use of CFCs, and we will make that available. We are planning a major conference in Singapore to deal with nations in that part of Asia, and to try to transfer whatever we can at that point. That is a cooperative effort, and we are playing a facilitating role.

In addition to that, we have funded and worked with three developing countries specifically on case studies on what it would take for them to phase out CFCs. We have worked with Egypt, Mexico and Brazil. In fact, the results of two of those were presented at the London meeting, and it was on that basis that we decided on the amount of money that would be needed in the fund.

Following on from those case studies, we expect that there will be quite a bit of U.S. Government and industry involvement in making it possible for those countries to phase out CFCs. So I guess I would characterize it as a partnership in an ongoing kind of way, and one where things, I think, are working extremely well.

Mr. **Skaggs**. Do you anticipate any difficulty at all in advances that are proprietary, by U.S. industries being made available to the rest of the world community?

Ms. **Claussen**. I think the way we have established the fund, if some of those licenses and patents are available they could be purchased from money provided in the Fund. I think there may be cases where some U.S. companies may not wish to transfer some of the technology for a variety of reasons. But I suspect there will always be some who have will have some of the technology for some of those uses.

So in fact, there will be technology transfer.

Mr. SKAGGS. In addition to the return of the Chairman, we have been joined by Mrs. Morella from Maryland, and I will yield to her at this time.

Mrs. MORELLA. That's very kind of you. Thank you. I appreciate this panel, it is very timely. Speaking to that, I would like to ask a question I hope you have not already responded to, and that is in terms of what's happening right now in Houston. We hear from some press reports that President Bush may be resisting efforts by the G7 nations to begin that process of freezing or reducing the greenhouse gases. I wonder if you might elucidate on that U.S. position, if you are privy to it.

Mr. SMITH. I don't believe I have any information you don't have. I am reading the same newspapers. It is a different issue than the one we are talking about here, the question of global climate change, where there is a different —

Mrs. MORELLA. But there are interrelationships.

Mr. SMITH. There are interrelations. But one of the reasons why we included in the amendments language which talked about the specific aspects of what we did on the Montreal Protocol was because we don't believe that what we created in London is simply a template which can be applied to other situations. The global climate change situation is much more complicated. From a research point of view, it is not as straightforward, and Dr. Watson may want to speak to that.

But also politically, and in terms of society's response, it is much more complex. It involves the whole concept of fossil-based energy societies and it may well be that that cannot proceed at quite the same pace, for a whole variety of reasons.

Mrs. MORELLA. Maybe someone else wants to comment on it. But maybe I can add to that kind of question the concept of what we have learned from negotiations which can be applied to the global environmental issues such as the greenhouse effect. Then, I am wondering whether or not when a position is determined by our country whether you are involved in it.

Mr. SMITH. I would be pleased to respond to that, but maybe before I do, Dr. Watson might want to say a little bit about the research questions involved, and the situations.

Mr. WATSON. Let me comment on the similarities and the dissimilarities between the ozone depletion caused by CFCs and greenhouse warming predicted to be caused obviously by greenhouse gases. I think the difference at this moment in time is that we have, as far as the science community is concerned, established a cause and effect relationship between the emission of CFCs and the Antarctic ozone hole.

We are also highly suspicious that the release of CFCs has also caused a decrease of ozone in the Northern Hemisphere. So as far as science goes, there is almost no doubt that CFCs have caused environmental damage, as witnessed by the Antarctic ozone hole.

With respect to greenhouse warming, as a part of the IPCC Working Group One scientific assessment, what we have stated quite categorically is our best models of today predict global warming. In fact, with what we believe emissions are likely to be over the next few decades, we believe that the earth would warm at about 0.3 degrees per decade. So it would warm about one degree over the next 30 years.

However, we pointed out two other very important points. One, there is substantial scientific uncertainty. The magnitude of the global warming is predicated upon our understanding of all the clouds, while the timing of the global warming is predicated upon our understanding of the exchange of energy and chemicals between the atmosphere and the oceans. Also, we tried to look very carefully at the last 100 year record of atmospheric temperature, and we concluded two things.

We first concluded that the earth has warmed probably somewhere between 0.3 and 0.6 degrees Centigrade in 100 years. But then when we tried to see whether cause and effect could be established between the greenhouse gases and the observed warming, we had to come down with the following statement. We said that while the observed warming was broadly consistent with the greenhouse gas theory, it was also consistent with the magnitude of natural variability.

Therefore, simply stated, we cannot, unfortunately, use the last 100 year record to say whether the enhanced greenhouse effect due to human activities has started or not. Most scientists do believe this is a very serious issue. There is no question about that. We do believe greenhouse warming will occur. At this moment in time, though, the simple difference between the greenhouse warming situation and the ozone situation is cause and effect has been established with respect to CFCs and ozone but has not yet been established between greenhouse gases and global warming.

Therefore, governments have to decide whether they should rely on these models which do have uncertainty, that we all recognize, or whether they want to be prudent, and have regulations to try and avoid what is predicted by those models.

Mrs. MORELLA. Does anyone else want to comment on that area? Your comment, Mr. Watson, sounds like what they call the precautionary principle.

Mr. SMITH. Perhaps I could answer your other question about what we have learned. I think we have learned a great deal, and I am delighted to have an opportunity to talk about it a little bit. I think what we have learned is that to achieve the kind of result we did in this situation, it is important to proceed at a pace which allows a consensus to build which includes the affected interests, both business and environmental, and builds very carefully on the science, and makes very clear links between science and technology assessments and control measures.

Particularly interesting is the fact that the Montreal Protocol was preceded by the Vienna Convention by a couple of years, which identified the problem, which alerted the world community to the need to address it, and led to a series of very fruitful workshops in which business and scientists, and government people were brought together, and then led to the Montreal Protocol, and the fact that the Protocol itself was a living document.

We knew, although it was our best guess in 1987, that there would be new science which would require changes. So what was critical, and unusual in an international agreement, I would say, is the degree to which the capability for change was built into the

Protocol. I think that's a very important process to keep in mind, that whatever we do in other areas, we should never think we know it all when we do it for the first time, and we should do what we very prudently did in the case of the Vienna Convention and the Montreal Protocol, and build in the capacity to keep going back to the question, and keep taking into account new information from year to year, as it develops, and to make the changes.

That's what makes me feel so good about this process as precedent for other things. Others may want to comment on that.

Mrs. **Morella**. Well, in the interests of time, thank you, Mr. Chairman, I yield back.

Mr. **Skaggs**. Thank you. Let me turn to our chairman.

Mr. **Scheuer**. Let me ask you all if we have provided for the ability to react to new perceptions, new facts, new scientific certitudes as they come upon us? Do we have the ability to provide oversight and ongoing surveillance that we can crank into the process and change things?

I don't know if it has been mentioned this morning, but not more than about a year ago, the Dupont Corporation presented much of its research and announced that they thought the Montreal Protocol results were inadequate, that we could not wait until the end of the century to cut CFC production by half, that we ought to cut it out entirely, and do it now. That was based on their ongoing research that had taken place, I suppose, much of it, since the Montreal Protocol was signed.

Do you feel we have the institutional capability of staying at the cutting edge of knowledge and insights, that we can adjust this regulatory format to reflect new realities as they become apparent and become accepted?

Mr. **Smith**. If I can start the ball rolling on this, I am sure others will want to comment on it. I want to reiterate what I said to Mrs. Morella, that I find it remarkable in terms of international practice, the degree to which we have exactly accomplished what you are referring to. That has created a dynamic and flexible instrument that has shown, in the brief years since 1985, the Vienna Convention, and 1987, the Montreal Protocol, the capacity for a response to new data and tremendous change.

The world community does not usually move this fast. I am hard pressed to think of any other instance when we have had a multilateral agreement of this kind that has so fast and so flexibly responded to new information. I am very encouraged by that.

Ms. **Claussen**. Just to add to that, we had assessments of the science and the technology and the environmental effects and economics underway within months after 1987 and the signing of the Montreal Protocol. All of those things were completed. The parties looked at all those things and decided that in fact things were inadequate. We went back and spent about the last year trying to negotiate all of these controls, based on what those technology assessments and science assessments told us. So yes, I think we have an excellent process for doing exactly that.

Mr. **Scheuer**. Let me ask one more question, then I think we will be finished and will wind up this panel.

What should the respective roles of the public sector and the private sector be in terms of the technology transfer to the developing world that everybody seems to feel is so important? What other theoretical roles—and are there any impediments now in Federal law and regulation that would impede what the consensus might be as to the way and to the degree and the order of magnitude of technology transfer.

Mr. **Smith**. I would just make the general point that I think the case is compelling, the way we have done it, the kind of cooperation between government and industry where we have brought them in to help us with the science assessment and to all aspects of what we are doing. It has proved very fruitful. It certainly would not be a good idea, in my idea, for the government to try to play a stronger, or more regulatory, type of approach.

I am very encouraged by what I see as the dynamic of what is happening in the private sector and the development of substitutes, the eagerness I see on the part of the concerned industry to address this problem and to work with developing countries and others to achieve it. So I think we are basically getting enough.

Mr. **Scheuer**. I detect a certain amount of unhappiness in the developing world that they are not getting enough technology transfer, fast enough, and that the prices are too high, and a certain amount of gouging and exploitation, and a lot of nasty, unpleasant things are occurring. I don't think you can say that the free market produces a lot of happy campers in the third world. Maybe as you answer, Mr. Reinstein, and Ms. Claussen, you can sort of address my perception that there is a lot of unhappiness in the third world.

Ms. **Claussen**. I guess I would view it more as a partnership between Government and industry. Before you came back, I did reiterate some of the things we have going where we have memorandums of understanding with different industry groups to try to work on the substitutes and see that those technologies are transferred.

I actually don't think there is that much unhappiness in the third world. We spent an enormous amount of time with these countries over the past year, and even in this last meeting, trying to discuss and trying to reach a consensus on how the technology would be transferred, under what kinds of terms, whether the funding would be adequate to pay for the technology, how fast it would get there, whether they could meet their control schedules on time, and would things be available.

I think we actually worked out an extremely good consensus where everyone, including the probably 40 or 50 developing countries that were present in the room were quite happy with the results. The two major ones, who were not yet parties, China and India, said that they thought they would proceed to join based on the kinds of agreements that had been reached.

So there may not be a lot of happy campers, but I think they are happier than you may think.

Mr. **Scheuer**. Well, that's encouraging.

Mr. Reinstein?

Mr. **Reinstein**. Well, Mr. Chairman, the transfer of these technologies basically results from commercial negotiations between the companies that own the technology and that developed it and those people who want it. Negotiations generally don't take place overnight. They take place over a number of months. Our understanding is that these negotiations are going on.

Now, obviously, there are some countries which would prefer to have the technology basically given to them up front without having to go through these negotiations, and there are some countries which have stated explicitly that the technology should be transferred without regard to protection of intellectual property rights. As you may know, this is a subject of considerable debate in the GATT right now, how protection of intellectual property rights affects trade.

We certainly have a strong view that you must provide adequate protection of intellectual property rights, or people simply will not develop the technology that is needed to solve our environmental problems.

Mr. SCHEUER. Well, I suppose they will develop it for a first world market, where their intellectual property rights would be respected, but then if there is no consensus in the third world that they are prepared to respect intellectual property rights, there would be a major problem with technology transfer from the first world to the third world.

Mr. REINSTEIN. The first world and the third world are not entirely separate. They are in fact linked by international trade. If technology goes into the third world without adequate protection of patents, the result of that results in products that come back into our markets, and in fact displace our own products in our own market, without adequate compensation for the value of the technology transferred.

All of this has to be taken into account, and an appropriate balance reached between the commercial considerations that have to be addressed in order to have the technology developed in the first place, and the imperatives of having that technology spread as widely as possible in order to protect the environment. It is a rather delicate balance, and I think we are moving into this area in a rather good way. I think the results of the London meeting were very positive in that regard.

But we haven't solved all the problems up front, we are going to have to continue to work on them as we go along.

Mr. SMITH. Mr. Chairman, I just want to add one point to build on what Ms. Claussen said. At the end of the meeting, when India and China made their statement that they were pleased with what we had achieved and were going to recommend adherence, there was very vigorous applause that was joined in by all the developing countries there. I think we ended that meeting with a clear indication that they accept the way we are proceeding to do the job. I was very encouraged by that result.

Mr. SCHEUER. Am I hearing correctly that basically you are not suggesting much of a role for Government except to get out of the way, and make sure there are not any impediments?

Ms. CLAUSSEN. Actually, it's a much more proactive role than that. For example, when we did studies in Mexico, Egypt and Brazil, they were sponsored by the U.S. Government, and we had industry participation. Now, we would see a lot more of that as we move on in this. I think it is a partnership, it is not a passive role.

Mr. **Reinstein**. I might note that the Commerce Department has also been involved in promoting the development and export of U.S. technologies and so on. So there are some clear commercial opportunities here for enhancing our trade. The Government has played a very active role in export promotion in that regard.

Mr. **Scheuer**. We have been joined by Congressman McMillen from the great State of Maryland, and are happy to have him. I might say that you should take note that we have five members—six members present, which is truly an unusual occurrence. So it does indicate the tremendous Congressional interest in this whole question of CFCs and what we are going to do about it, to preserve this fragile planet Earth.

Any other questions from anybody?

Mr. **Boehlert**. No, Mr. Chairman, just one observation. Before the panel is allowed to be dismissed, I think we should collectively thank them. They were the good guys in London wearing the white hats, moving in the direction that you and I and most of us want to move. Not all people in the Administration wear white hats on these very sensitive issues. But we have the good guys in front of us, and I want to thank them.

Mr. **Scheuer**. Well, I suppose we have the good guys before us, and I think we can assume—this is just a barely rebuttable assumption—that they had something to do with the change in the Administration's posture, don't you believe that?

I don't ask them to verify that.

Mr. **Boehlert**. Yes.

[Laughter]

Mr. **Scheuer**. But if it is a barely rebuttable presumption, we thank you for your appearance and we thank you for all your good work on stage center, and also back in the wings over the many, many months. Thank you very much for a remarkably interesting panel.

All right. We will go now to the second panel. Liz Cook, Kevin Fay, and Paul Cammer, please take your seats.

We are limiting, as you know, our testimony to five minutes. Your full prepared statements will be printed in the record at the point at which you speak. We would enjoy it if you liberated yourself from the printed word and just chatted with us informally, and hit the highlights of your testimony, and perhaps refer to anything that took place while the first panel was on deck.

With that, we will start with Liz Cook, Ozone Campaign Director, Friends of the Earth.

STATEMENT OF LIZ COOK, OZONE CAMPAIGN DIRECTOR, FRIENDS OF THE EARTH

Ms. **Cook**. Thank you very much, Mr. Chairman, and members of the subcommittee.

I am Liz Cook, Ozone Campaign Director, Friends of the Earth. We are the U.S. Affiliate of Friends of the Earth, International, a network with 37 member organizations around the world. My statement this morning is made on behalf of our 45,000 members and supporters of our global advocacy group.

We greatly appreciate the invitation to appear here this morning and share our views on the outcome of the Second Meeting of the Parties to the Montreal Protocol. I had the privilege of observing at this meeting as part of the Friends of the Earth International delegation. I was among several representatives of Friends of the Earth groups in Argentina, Canada, Indonesia, West Germany, the United Kingdom and the United States.

At this time I would like to submit for the record a series of three things we presented and distributed at this meeting that describe the ozone problem and demonstrate the need for comprehensive action.

[Material to be inserted follows:]

OZONE PROTECTION CAMPAIGN

BRIEFING SHEET

Where Friends of the Earth International stands

It is now beyond doubt that CFCs, halons, methyl chloroform, carbon tetrachloride and HCFCs are rapidly destroying the stratospheric ozone layer, and making a substantial contribution to global warming. This new scientific understanding confronts the people of the world with a genuine global emergency.

The Montreal Protocol, the international agreement to control ozone depleting substances, will be revised in London from 20-29 June. Substantial changes are needed to allow the Antarctic ozone hole to recover next century and to stave off the risk of severe Arctic depletion.

The industrialised nations have been, and are now, the main sources of CFCs and related chemicals. They therefore bear the main responsibility to ensure that measures are implemented to address ozone depletion.

The crisis can be met only by a worldwide crash programme to eliminate production and use of the offending chemicals. Friends of the Earth International calls upon world leaders to revise the Montreal Protocol to include the following:

Strengthen control measures

- Phase out the production and consumption of CFCs, halons, methyl chloroform and carbon tetrachloride by 1992, in no case later than 1995.
- Ban immediately the use of any ozone-depleting gas as an aerosol propellant (except for essential medical uses).
- Phaseout HCFCs in new equipment by 2005, in existing equipment by 2010. Until then, confine HCFC use to essential applications where chlorine-free substitutes are not yet available, choosing those which contribute least to ozone depletion and global warming.
- Make recovery and recycling obligatory (where technology exists) of ozone-destroying chemicals in all industrial processes and during the service and disposal of products containing these chemicals.
- Require labelling of all products containing or manufactured with ozone-depleting substances through an internationally standardised system of warning labels.

Assist developing countries

- Provide developing countries with only five additional years to phase out CFCs, halons, methyl chloroform and carbon tetrachloride.
- Direct industrialised countries to provide developing countries with the funding they need to eliminate production and use of ozone-depleting substances on the faster timescale set. The funding should cover all the added costs of complying with the obligations of the Protocol.
- Guarantee provision of 'new' or 'additional' funding, with no diversion from funds currently supporting economic development in developing countries.

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- Require industrialised countries to contribute funding in proportion to their 1986 consumption of ozone depleting substances, encouraging the imposition of a 'polluter pays' tax on producers and users of these chemicals as a means of raising the funds.

Enforce its provisions

- Extend the Protocol's trade sanctions beyond CFC-related products to other goods and services.

- Apply the Protocol's trade sanctions against developing countries only if financial and technical assistance to comply with the Protocol has been provided by the developed countries.

- Require national governments to report and publish statistics regarding the production, import and export of all ozone-destroying chemicals from each individual company and production facility.

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OZONE PROTECTION CAMPAIGN

BRIEFING SHEET

Methyl Chloroform - Ozone Destroyer

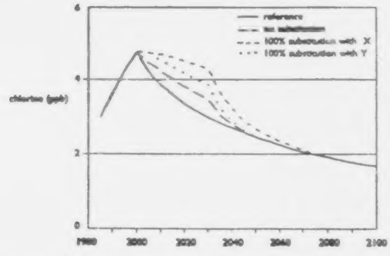
The link between CFCs and the destruction of the ozone layer is well known. Now scientists have evidence that another widely used synthetic chemical, methyl chloroform, often also known as 1,1,1 trichloroethane, is a significant ozone destroyer.

Every methyl chloroform molecule contains three ozone-destroying chlorine atoms and has an ozone depletion potential 15% that of benchmark CFC 11. UNEP calculates that methyl chloroform was responsible for 13% of the ozone-destroying chlorine emitted to the atmosphere in 1985.

Methyl chloroform has a much shorter atmospheric lifetime than the CFCs and this means the effect of a methyl chloroform ban will be felt relatively quickly. The US Environmental Protection Agency has stated that "...a phaseout of methyl chloroform would be the single most important source for near-term reductions in stratospheric chlorine concentrations."

If methyl chloroform production continues after CFC production has been phased out, the level of ozone-destroying chlorine in the atmosphere will remain 0.5 parts per billion higher than it would otherwise be. This number sounds small, but natural levels are only 0.6ppb. The US Environmental Protection Agency has confirmed that the difference between a phaseout and a freeze represents a 40% increase in risk from today's high levels of 3.0ppb.

The Effect of a Methyl Chloroform Phaseout
This assumes elimination of CFCs, carbon tetrachloride and HCFC 22 in the year 2000, and compares continued use of methyl chloroform until year 2030, with different less depleting compounds substituted.



The UNEP analysis should end arguments that the chemical's relatively short lifetime allows a delay in the phasing it out; rather, it elevates the priority of doing so rapidly. The health and environmental consequences of prolonging its use into the next century are unacceptably high.

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Methyl Chloroform Uses

Methyl chloroform was introduced as an all-purpose solvent in the 1950s. By 1984, the United States, Western Europe and Japan used 545,500 metric tonnes of methyl chloroform.

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The major use of methyl chloroform is in metal cleaning operations throughout industry, accounting for 70% of global use. It is also used in smaller quantities as a solvent in adhesives, electronics cleaning, coatings, and inks and as either the active ingredient or a solvent for the active ingredient in aerosol products.

Methyl Chloroform Substitutes

The United Nations Technology Review Panel Report states that substitutes exist for 90-95% of methyl chloroform uses. Most of these substitute solvents are water based, but there are also terpene based solvents which can perform the same function. Alcohols, glycol ethers, pyrrolidone-based chemicals are among many other cleaning agents under investigation.

Methyl Chloroform Producers

There are only 12 companies in the world that produce methyl chloroform. Dow Chemical is the world's largest producer, supplying 40% of the global market.

Initial producer reaction to evidence of the importance of methyl chloroform for rapid reduction of chlorine levels was opposition to controls. A Dow Chemical US circular last October urged customers to inform Senators that restrictions could seriously harm their business. In the UK, ICI has likewise urged clients to write to MPs and the DOE to make their views about regulation known. US industry alliance HSIA brochures warn that over 3,000,000 production workers rely on it, raising fears of "business shutdowns, loss of competitiveness and job layoffs". Environmentalists can be forgiven a sense of deja vu, when early reactions to demands for an end to CFC use are remembered.

Prospects for a Ban

The chemical industry now accepts the need for some movement, calling for a freeze in production levels in 1992, and a 25% reduction in the year 2000 - targets which could be achieved by conservation techniques alone. Their view that a complete phase-out of methyl chloroform production is not required until the middle of the 21st century is at odds both with environmental concern, and the policy of a growing number of governments.

Sweden will ban methyl chloroform in 1994, West Germany in 1992. The US Congress has voted an amendment to the Clean Air Act to phase out methyl chloroform completely by the year 2000 - a clear signal of intent. If some industrialised countries can forge ahead, so can the rest.

Although efforts are afoot to include methyl chloroform in the Montreal Protocol and agree a phaseout date, the EC and Japan are blocking progress. The EC is content to allow half the production to continue well into next century.

Friends of the Earth International will press hard for a total ban in the next two to five years. Concentrations of ozone-destroying chlorine are rising fast to unprecedented levels. Early elimination of methyl chloroform is the key to reducing the imminent risk of severe Arctic depletion. Governments cannot afford to delay effective action.

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OZONE
PROTECTION
CAMPAIGN

BRIEFING SHEET

Developing Countries and The Montreal Protocol

A weakened ozone layer will be less able to shield the earth from damaging UV radiation. Developing countries stand to suffer most from the effects. Their already hard-pressed medical services will be hit hardest by increased cases of blindness due to cataracts, and infectious diseases. Reduced crop yield and declining fisheries will be of most consequence where food supplies are already scarce. Scientists have confirmed worldwide losses of ozone of up to 3 per cent over a densely populated region covering most of Europe, Japan, USA, and USSR and much of China, Pakistan, Iran and Canada.

Why Developing Countries Must Cut CFC Use

UN scientists have shown that only with the complete phaseout by all countries of CFCs, halons, carbon tetrachloride and methyl chloroform, and curbs on HCFC substitutes, will the ozone hole disappear - and then not until 2100.

If 10% of current use of these chemicals continues, it will delay the elimination of the Antarctic ozone hole by over 100 years, until 2175. If 20% of use goes on, the Antarctic ozone hole would NEVER disappear. Clearly all countries must end their use of these chemicals if the ozone layer is to be protected.

Developing Country Production and Consumption

In 1986 the developing world accounted for only 15 per cent of world consumption of CFCs and per capita consumption was 10 times less than in the industrialised states. Demand is rising rapidly and now nine developing countries are producing or planning to produce their own CFCs.

India (24,000 tonnes), China (20,000 tonnes), and Brazil (17,000 tonnes) are the major producers, closely followed by Argentina and Mexico (10,000 tonnes each). Others include Taiwan, South Korea, Venezuela and Indonesia. Total CFC production potential in the Third World appears to be about 110,000 tonnes. Many of the plants are newly-built and have not yet reached their full production capacity. Nevertheless, most countries have plans for further expansion - China expects to be producing 40,000 tonnes by 1995.

Developing Countries and The Montreal Protocol

The special needs of developing countries have become an increasingly contentious issue. For, although they bear little responsibility for depletion of the ozone layer, their hard pressed economies will not be able to cope with phasing out chemicals on which their industries have come to depend without some kind of financial and technical support. Developing countries are reluctant to commit themselves to the Protocol without first being assured of such support.

Only 28 developing countries have become parties to the Montreal Protocol, five others have signed but not ratified. Key manufacturers, India and China, are still standing on the sidelines.

The principle of compensation is recognised in the Montreal Protocol. Article 5.1 permits developing countries with consumption below 0.3 kg per head to delay compliance with the control measures by 10 years. Article 5.3 promises to facilitate bilaterally and multilaterally the provision of subsidies, aid, credits, guarantees, or insurance programmes to Parties that are developing countries for the use of alternative technology and for substitute products.

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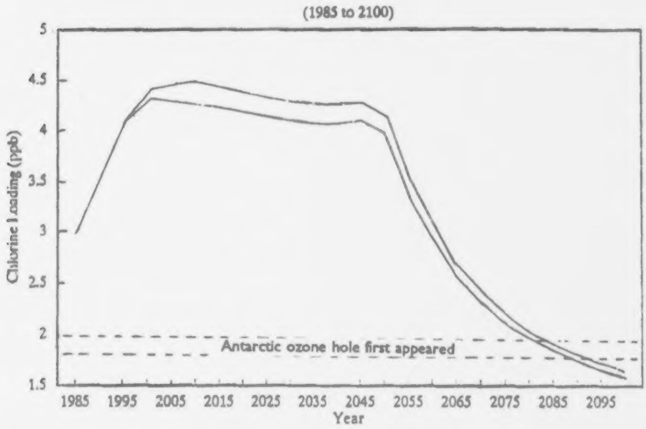
There are in fact, important environmental benefits in providing developing countries with sufficient funds to allow them to phase out all ozone depleting chemicals faster A five year, rather than ten year, delay will allow the Antarctic ozone hole to recover more quickly, and will significantly lower the amount of ozone-damaging chlorine during the first half of next century.

Comparison of a 10 year delay by developing countries to a 5 year delay of the likely control measures



By the time the Protocol came into force on 1 January 1989 it had become clear that its provisions were inadequate. Developing nations were suffering a crisis of confidence because nothing had been done to make the provisions of Article 5 a reality. During the many subsequent discussions on funding, clear differences of opinion have surfaced as to what might constitute an appropriate funding mechanism.

The Cost of Eliminating CFCs

Developing countries insist that 'new money' be provided, that funds be in addition to ordinary aid, and concessionary. They also want contributions by developed states to be mandatory and enforceable. Developed countries have not begun to tackle the problem of "burden-sharing" or how they should divide the cost of technology transfer among them. Some prefer the assessed contributions to be based on 1986 consumption of CFCs - a 'polluter pays' tax which could be levied from CFC producers - others feel the UN scale or a percentage of GNP would be more workable.

When the Montreal Protocol is revised in London in June, Parties are fully expected to set up a funding mechanism to compensate developing countries for costs incurred - estimated at $300 million for the first three years - and to ensure transfer of technology.

These costs are likely to be underestimates, especially if some countries choose to phase out these chemicals faster than legally required, assuming developed countries guarantee to cover the cost of early amortization of CFC plant. Furthermore, it is not clear whether the increased costs of imports will be covered, the key cost for many smaller countries.

To put the sums in perspective, the first year US contribution would be equal to a sixteenth of what has been raised from the levy on US CFC-producers.

Choosing Appropriate Alternatives

Developing countries face difficult choices between competing CFC substitutes, in particular how much of their market the ozone-depleting HCFCs should be allowed to capture. Inappropriate decisions now may aggravate environmental damage and be costly to rectify in the future. It is vital that information about all possible alternatives is made readily available.

Some developing countries are keen to develop their own HCFC plants, reluctant to become dependent once more on imports. The chemical industry is reluctant to establish such production units, preferring to maximise domestic plant capacity before risking investment elsewhere. They argue that funding should be used instead to enable companies in developing countries to use, not produce, the new chemicals.

Given the availability of chlorine-free alternatives, a shrewder long term strategy would be to pursue guarantees of funding for existing and third generation alternatives wherever feasible. Otherwise, developing countries risk being locked into new uses of chemicals which the industrialised world is attempting to rid itself of.

Agreeing a Funding Mechanism

Developing countries, UNEP and Norway originally favoured the establishment of a new world climate fund. The main aid donors - the US, UK, Japan and Germany - preferred finance to be channelled through existing bilateral programmes, or established institutions such as the World Bank, setting up a mechanism which would serve as a clearing house, linking project requests with existing agencies.

It is clear that some sort of mechanism is likely to be set up under the control of the Parties to the Protocol, combining the functions of both a clearing house and a fund. Implementing programmes financed in this way may be jointly handled by UNEP, UNDP and the World Bank.

Since the World Bank set up the Global Environment Facility with $1.2 billion special drawing rights - to tackle projects involving ozone, climate, biological diversity and water resources - it has become a prime candidate for location of any special fund which might be established under the Montreal Protocol, despite the ingrained suspicion of the World Bank held by a number of developing countries.

All these issues will be debated again at the London meeting. It is vital that they are resolved to the satisfaction of the developing states, so that they will feel able to accede to the Protocol. Unless they do, any tightening of existing controls will be meaningless.

Conclusion

What is clear to all nations is that the ozone layer needs swift action, which only international cooperation and trust can deliver. As the world wonders how to grapple with the climatic disruption and global warming, this early experiment will come under close scrutiny. The scientific case is not in doubt. There are alternatives to CFCs; the costs of change are relatively low; the benefits of action unquestionable. If this manageable problem cannot be resolved, the chances of arresting the greenhouse effect will be poor indeed.

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FoE International Policy

Parties to the Montreal Protocol, meeting in London from 20-29 June should agree to the following measures:

1. Provide developing countries with only five additional years to phase out CFCs, halons, methyl chloroform and carbon tetrachloride.

2. Direct industrialised countries to provide developing countries with the funding they need to eliminate production and use of ozone-depleting substances on the faster timescale set. The funding should cover all the added costs of complying with the obligations of the Protocol.

3. Guarantee provision of 'new' or 'additional' funding, with no diversion from funds currently supporting economic development in developing countries.

4. Require industrialised countries to contribute funding in proportion to their 1986 consumption of ozone depleting substances, encouraging the imposition of a 'polluter pays' tax on producers and users of these chemicals as a means of raising the funds.

5. Extend the Protocol's trade sanctions beyond CFC-related products to other goods and services.

6. Apply the Protocol's trade sanctions against developing countries only if financial and technical assistance to comply with the Protocol has been provided by the developed countries.

7. Ensure that no more than 20% of the calculated assessment of a particular donor country is contributed via bilateral channels.

8. Ensure the full involvement of technical experts and environmental groups in developing countries in the choice of substitutes, avoiding HCFC alternatives wherever technically possible.

9. Call upon industry to rise to the global challenge presented by ozone depletion by offering technical know-how on alternative processes on a non-proprietary basis.

10. Guarantee that the costs of early amortization of CFC plant and best available technologies for abatement of pollution associated with CFC substitutes are fully covered by the Parties.

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OZONE
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Countries that Must Become Better Ozone Protectors

It is now clear that the Montreal Protocol on Substances that Deplete the Ozone Layer is totally inadequate. Even if all nations follow its provisions to the letter, the ozone layer will never recover from the damage we have inflicted upon it.

Scientists agree that if the ozone layer is to be saved, governments must radically strengthen the Protocol. We must rapidly end our production and use of the major ozone-destroying chemicals: CFCs, halons, methyl chloroform, carbon tetrachloride and HCFCs.

Unfortunately, many countries remain unwilling to take the strong measures necessary to save the ozone layer. Some of the differences between the Parties are outlined as follows:

CFCs

■ **Not one government has formally proposed an earlier phaseout date than the year 2000.**

This failure of nerve is all the more difficult to comprehend given that several countries have national action plans to eliminate CFCs by much earlier dates. The response of Sweden, Norway, West Germany, Australia and New Zealand to domestic pressure, has not been matched on the international stage, to the great disappointment of environmentalists.

■ **Parties are divided about how quickly early CFC cuts can be achieved.**

Canada and Australia are refusing to accept any more than a 20 per cent cut in production before 1997. All other countries have indicated they would be willing to accept at least a 50 per cent cut by 1995. The US and Japan will not cut CFC consumption by more than half by 1995 - the date a number of countries intend to eliminate all CFC use.

Halons

■ **Parties are reluctant to cut production quickly and rely on banked stocks.**

Halons are the most potent ozone depleters. The major producers and consumers - the US, USSR, Japan and the EEC - are resisting Nordic attempts to stop production of halons in 1995, using stocks of halons in existing equipment to meet any remaining essential uses. The majority of countries prefer to allow the chemical industry to add more than half again the amount of halons ever produced before calling a halt in 2000.

Methyl Chloroform

■ **There is no agreement on whether to eliminate, or merely to cut, use of methyl chloroform.**

The European Community is opposing attempts to set a phaseout date for methyl chloroform, the key to reducing the risk of a severe Arctic ozone hole. Japan is only willing to support industry's position of a 25 per cent production cut by 2000 - essentially painless because it can be achieved by conservation - and a phaseout in the middle of the next century. All other countries are promoting or considering a complete end to methyl chloroform production in the year 2000.

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Carbon Tetrachloride

■ No decision has been reached on the best phaseout date.

The European Community and Japan remain committed to a phaseout of carbon tetrachloride in the year 2000 while many countries area calling for an end to this chemical's production in 1995. Carbon tetrachloride is mainly used as a chemical intermediate in processes such as CFC production. The Parties intend to exempt all such uses from control.

HCFCs

■ The Parties may leave the ozone-destroying substitutes free from control.

Canada and the European Community have made it clear that they do not want the production of these chemicals to be restricted in any way under the revised Protocol. The EC even opposes inclusion of HCFCs for the purpose of formal reporting of the amounts produced. The United States and Japan do recognise the need to phase out these chemicals, but would delay action until near the middle of the next century. Only the Nordic countries, Switzerland, New Zealand, and Australia are calling for a phaseout of these chemicals in 2010.

Parties reluctant to control the next generation of ozone destroyers are trying to deflect public criticism by pressing for a "declaration", urging industry to use these chemicals responsibly.

Developing Countries

■ The Parties have not yet agreed to provide "new" fundings for developing countries.

The US is the only country blocking agreement on provision of new funding to assist developing countries in implementing the provisions of the Protocol. It is determined to siphon the money from funds already targeted to assist economic development in these countries.

Summary

All too often negotiating positions reflect particular national circumstances. To give but a few examples:

■ The EC countries failed to ban use of CFCs in aerosols before the Montreal Protocol targets were agreed. As a result deep early cuts in CFC use - in some cases up to 50 per cent - have already been achieved with minimum effort by governments, but with considerable effort by consumers and environmental groups. The US, however, which banned aerosol uses in 1978, is reluctant to enforce stringent reductions which would entail tackling the more difficult industry sectors early on.

■ Japan consumes a high proportion of CFC 113, a solvent widely found in electronics and computing, and has been wary of control measures which may jeopardise continued use in these key sectors. This stands in stark contrast to Swedish measures which will ban all solvents use in electronics by 1 January 1991.

■ Weather can be an influence, with air conditioning use more widespread in hotter countries. The temperate climate in Britain ensures widespread public acceptance that car air conditioning is unnecessary, a use which accounts for 21 per cent of US consumption, and which is a major obstacle to rapid change.

FOEI rejects all such special pleading. We are convinced, based on analysis of substitutes available and emerging, that all countries can and should eliminate CFC use by 1992, and in no case later than 1995, whatever their domestic consumption patterns.

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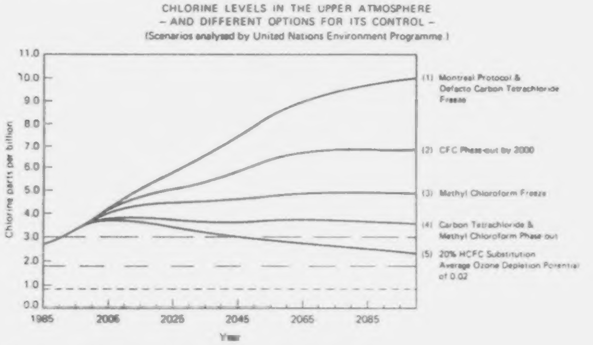
What Lies Ahead For The Ozone Layer?

Within the ozone layer, ozone is regularly created and destroyed through natural processes. This natural balance has been altered by the emission of ozone-destroying synthetic chemicals, such as CFCs, halons, carbon tetrachloride, methyl chloroform and HCFCs (hydrochlorofluorocarbons).

Figure 1 summarises the task ahead. Unless all the ozone depleting chemicals are eliminated, destruction of the ozone layer will not end.


CHLORINE LEVELS IN THE UPPER ATMOSPHERE
– AND DIFFERENT OPTIONS FOR ITS CONTROL –
(Scenarios analysed by United Nations Environment Programme.)

0.6 ppb - natural level of chlorine in the atmosphere
1.5 - 2.0 ppb - level at which Antarctic ozone 'hole' is believed to have appeared
2.7 - 3.0 ppb - current levels
- assumes that all countries fully comply

Two of the world's leading experts on the ozone layer, Dr. Robert Watson of the US National Aeronautics and Space Administration (NASA) and Dr. Daniel Albritton of the National Oceanic and Atmospheric Administration (NOAA), were asked by the United Nations to set out several phase-out scenarios and predict how the future of the ozone layer would be affected by each one. Their findings have been published by the United Nations Environment Programme (UNEP) and some of them are outlined in this briefing paper.

The UNEP assessment concludes that future risks of ozone depletion can be best analysed in terms of atmospheric concentrations of chlorine, or chlorine loadings.

■ The natural level of chlorine in the atmosphere is only 0.6 molecules per billion molecules of air (ppb).

■ The Antarctic ozone hole unexpectedly appeared when the chlorine content of the atmosphere reached somewhere between 1.5 and 2.0 ppb.

■ The current chlorine content of the atmosphere is 3.0 ppb and that level is increasing. This is a 500% increase over natural atmospheric chlorine levels.

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To protect the ozone layer, chlorine must be reduced towards natural levels, the Antarctic ozone hole allowed to recover and the risk of severe Arctic and worldwide ozone loss reduced. What emerges clearly from the UNEP analysis, is that different substances act in different ways. Some are vital for allowing the Antarctic ozone hole to recover, whereas the short-lived chemicals play a crucial role in reducing the danger of Arctic and worldwide ozone loss.

In their computer simulations, Watson and Albritton were primarily concerned with determining how each phaseout scenario affected the following:

(a) The date at which the Antarctic ozone hole may recover is assumed to be when chlorine levels drop below 1.5-2.0 ppb, the level at which the hole appeared.

(b) The maximum, or peak, level of chlorine in the atmosphere, which is related to the risk of additional severe ozone depletion. As levels rise, so does the threat of dramatic Arctic depletion. Moreover, the relationship between increased atmospheric chlorine and increased ozone destruction is not a linear one, as the sudden and unpredicted appearance of the Antarctic ozone hole has already demonstrated.

(c) The rate at which atmospheric chlorine levels decrease. The longer chlorine levels are kept high, the greater the risk of ozone destruction, and the more vulnerable the atmosphere is to meteorological conditions, volcanic eruption or other factors which may create conditions for further depletion.

The Need For a Rapid Phaseout

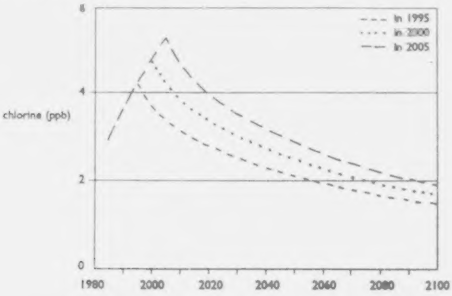
Each five year delay in the phaseout of CFCs, carbon tetrachloride, methyl chloroform and HCFC 22:

- delays the time taken to eliminate the Antarctic ozone hole by 18 years - even with a 1995 phaseout, the Antarctic ozone hole would be with us until 2055 and levels of atmospheric chlorine would not return to normal until well into the 22nd century.

- increases the peak level of chlorine in the atmosphere by 0.5 ppb. Even with a complete phaseout of these chemicals in 1995, the peak level of chlorine will rise from the current level of 3.0 ppb to an unprecedented 4.24 ppb.

The Antarctic ozone hole will take decades to recover because CFCs are long-lived substances some of which take over a hundred years to remove from the atmosphere.

Fig.2. The Effect of The Timing of A Phaseout
100% Cut of CFCs, Carbon Tetrachloride, Methyl Chloroform and HCFC 22



Interim Cuts Are Important In Moving To a Complete Phaseout

Early cuts of CFCs, carbon tetrachloride, methyl chloroform and HCFC-22 before the complete phaseout are also vital:

Assuming 50% cuts by 1995, compared to elimination of all the substances at once in the year 2000, UNEP concluded that:

- The Antarctic ozone hole would be eliminated 10 years earlier.

- The peak chlorine levels would be a significant 0.54 ppb lower than they otherwise would have been.

A Rapid Phaseout of Methyl Chloroform Is Essential

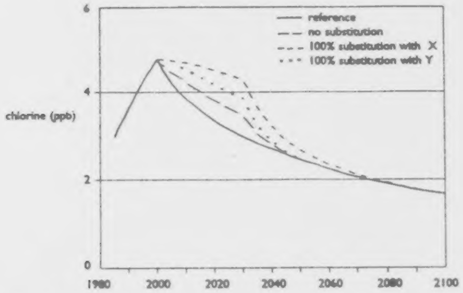
UNEP assesed the impact of delaying a year 2000 phaseout of methyl chloroform production by 30 years, but eliminating production of the other substances, concluding that:

■ Delaying to 2030 will keep chlorine levels elevated near the peak levels of 4.5ppb out to 2020, 0.5 ppb higher than they would otherwise be until that date.

The US Environmental Protection Agency has confirmed that the difference between a phaseout and a freeze represents a 40% increase in risks from today's levels.

Because it has a short lifetime, methyl chloroform use will not affect the date when the Antarctic ozone hole may recover, unless it is used up to 2050. It is however, the key to reducing the risk of Arctic depletion - it can be entirely cleansed from the atmosphere in a short period of time, and could therefore reduce chlorine levels more rapidly than controls on any of the long-lived CFCs.

Fig.3. The Effect of a Methyl Chloroform Phaseout
This assumes elimination of CFCs, carbon tetrachloride and HCFC 22 in the year 2000, and compares continued use of methyl chloroform until year 2030, with different less depleting compounds substituted.



The UNEP analysis should end arguments that the chemical's relatively short lifetime allows a delay in the phasing it out; rather, it elevates the priority of doing so rapidly. The health and environmental consequences of prolonging its use into the next century are unacceptably high.

The HCFCs Substitutes Are Also Ozone Destroyers

The UNEP analysis examines the effects of substituting substances named X and Y, which mimic the behaviour of HCFCs without representing a particular one, although X is almost equivalent to HCFC 22. It shows that limited use of HCFCs, rather than alternatives with zero impact on ozone, does not affect the date at which the Antarctc ozone hole is eliminated, but creates a plateau effect, keeping chlorine levels high for decades longer.

This is a high risk strategy given the dangers already posed by current levels, a problem compounded if HCFCs with higher (X) rather than lower (Y) ozone depletion potential are used. With indefinite substitution, it is difficult or impossible to achieve chlorine concentrations below 2ppb, allowing the Antarctic ozone hole to recover.

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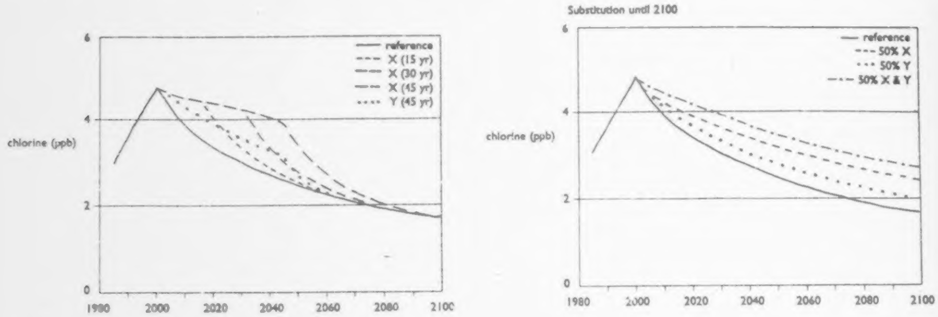
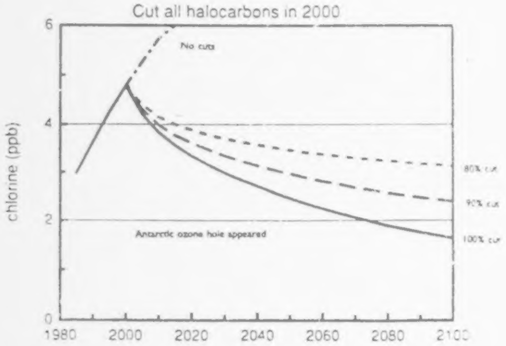
Fig 4. The Effect of Substitution with Different HCFCs for 15 - 45 years
These graphs assume elimination of CFCs, carbon tetrachloride, methyl chloroform and HCFC 22 by 2000 substituting all or a percentage of these with different compounds for specific timeperiods or indefinately.



All Countries Must Participate

If certain countries refused to end their use of CFCs, carbon tetrachloride, methyl chloroform and HCFC-22, resulting in global phasedowns of only 90% or 80%, the results would be disastrous:

- A 90% phaseout would delay the elimination of the Antarctic ozone hole by over 100 years. It would be with us until 2175.
- The Antarctic ozone hole would NEVER disappear if only an 80% phaseout is achieved.



Friends of the Earth International is campaigning for a phaseout of CFCs, halons, methyl chloroform and carbon tetrachloride, by 1992, in no case later than 1995, with immediate curbs on HCFC consumption and a phaseout date of 2005 in new equipment. FOEI is also calling on developed countries to ensure adequate funding is available to ensure 100% global participation.

A number of governments have formally proposed amendments which would tighten up the control measures in the Montreal Protocol. But it is clear that the likely revisions will not allow the Antarctic ozone hole to recover next century. Nor will vital steps to reduce the risk of severe Arctic ozone loss in the next few decades be taken.

These scenarios provide a benchmark against which the success or failure of proposals to revise the Montreal Protocol can be judged. There is little time left for governments to heed the warnings of the scientists and ensure the ozone layer is fully protected.

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The Science of Ozone Depletion

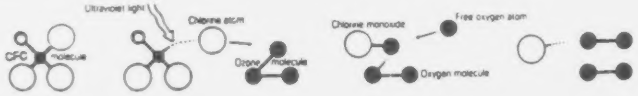
In 1974, two American scientists discovered that synthetic chemicals called chlorofluorocarbons (CFCs) could destroy the ozone layer in the upper atmosphere. The ozone layer has the important buffering effect of keeping dangerous wavelengths of solar radiation from reaching the Earth's surface. Since then, scientists have confirmed that CFCs and other chemicals - methyl chloroform, carbon tetrachloride, halons and HCFCs - are destroying the ozone layer at an alarming rate.

How Ozone is Destroyed

CFCs and other ozone-depleting chemicals are used in a variety of industrial processes and consumer products such as refrigerants, cleaning solvents, plastic foam blowing agents, fire retardants and aerosol propellants. They are very stable compounds and do not react with other elements in the lower atmosphere.

After these chemicals are used, they eventually escape into the air as gases and drift up into the stratosphere where the ozone layer is located. Once above the ozone layer's protection, the molecules are broken apart by rays of ultraviolet (UV) light. As they break up, they release chlorine atoms (bromine in the case of halons) which destroy ozone.

The diagram below shows how chlorine from industrial chemicals destroys a protective ozone molecule (O3) by reacting with it and converting it to an ordinary oxygen molecule (O2). Since the chlorine atom survives the ozone-destroying reaction, it is free to repeat the process. This chain reaction can go on for decades - one CFC molecule being able to destroy up to 100,000 ozone molecules.



In the upper atmosphere ultraviolet light breaks off a chlorine molecule

The chlorine attacks an ozone molecule breaking it apart. An ordinary oxygen molecule and a chlorine monoxide molecule are formed.

A free oxygen atom breaks up the chlorine monoxide. The chlorine is free to repeat the process.

The Polar Ozone Holes

Scientists have discovered that each year industrial chemicals chew a large hole in the ozone layer over Antarctica. In 1987, chlorine and bromine destroyed more than 50 per cent of the protective ozone over the South Pole. Between the altitudes 15km and 20km, 95 per cent of the ozone was gone.

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The hole appears after the long polar night and varies in size from year to year. The 1989 hole over Antarctica covered an area the size of the United States. During the polar night, in winter, strong winds isolate the region creating a closed weather system called the "polar vortex". This air becomes extremely cold, permitting clouds of ice particles to form which provide excellent surfaces for the ozone-destroying reactions involving chlorine and bromine.

When spring comes and sunlight returns to Antarctica, solar UV radiation sets off rapid ozone-destroying reactions within the vortex, drastically thinning the ozone and creating the so-called "hole".

Eventually warmer temperatures break apart the polar vortex and the ozone-poor air spreads out over a wide area. In 1987, Australia and the southern regions of South America and Africa recorded a 7 per cent decline in ozone levels for several weeks after the polar vortex broke up.

Recently, scientists have found that, although the depletion has not been as severe as in Antarctica, all the ingredients necessary for drastic ozone depletion exist in the Arctic stratosphere. In 1989, levels of chlorine monoxide were found to be 50 times higher than predicted, and NASA has since confirmed that some regions of the Arctic suffered ozone losses of up to 17 per cent.

Volcanoes and Ozone Depletion

When volcanoes erupt, they frequently spew large quantities of sulphur particles into the air. These particles, like the ice particles in the polar clouds, could provide surfaces for ozone-depleting chemical reactions. In addition, volcanoes often emit chlorine compounds which may act like CFCs in the stratosphere to destroy ozone.

Atmospheric scientists have proposed a connection between the 1982 volcanic eruption in Mexico and a subsequent drop in stratospheric ozone levels in the middle latitudes of the northern hemisphere. If this connection proves correct, future ozone depletion may be greater than current predictions.

Can the Ozone Layer Recover?

Because ozone is formed naturally by a reaction of oxygen and UV sunlight, the ozone layer could eventually recover if the atmosphere were cleansed of industrial chlorine and bromine. However, the concentrations of these chemicals is certain to increase for many years due to the chlorine and bromine tied up in long-lived chemicals already in the atmosphere. A United Nations scientific assessment of the Montreal Protocol controls predicts further ozone depletion of 4-12 per cent at high northern latitudes if the agreement is not strengthened. Since 1969, there already has been a three per cent depletion of the ozone layer over a wide and densely populated area of the northern hemisphere.

Further surprises cannot be discounted. Higher chlorine levels are certain over the next few decades, but these are uncharted waters. Scientists warn of additional non-linear responses, as already evidenced by the sudden and unpredicted appearance of an Antarctic ozone hole, when chlorine levels reached 1.5-2.0 parts per billion (ppb). The ozone layer has demonstrated its capacity for unpleasant surprises.

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The Human and Environmental Effects Of Ozone Depletion

It is now beyond doubt that chemicals such as CFCs, halons, methyl chloroform, carbon tetrachloride, and HCFCs are causing massive depletion of the the ozone layer. This layer is the Earth's shield against dangerous ultraviolet (UV) light from the sun. Increased doses of UV light will have damaging effects on humans, animals, plants, and synthetic materials.

Ozone and UV-B

Ozone is a molecule made of three oxygen atoms. It is present throughout the atmosphere, although it is concentrated in the upper atmosphere, known as the stratosphere.

A large portion of the biologically damaging rays from the sun are absorbed by ozone. Ultraviolet light with very short wavelengths, called UV-B, is the most dangerous. Earth's ozone layer normally absorbs 95-98 per cent of these rays.

However, as ozone depletion continues world-wide, UV-B radiation will increase. Scientists estimate that every one per cent decline in the ozone levels leads to a two per cent increase in the amount of UV-B radiation that gets through to the surface. Increased UV radiation was recorded last year in Antarctica, and recently at a Swiss mountain station.

Risks to Human Health

Skin Cancer - Any long-term increase in UV-B radiation will increase the number of skin cancers, including dangerous melanoma varieties. Scientists now believe that a one per cent decrease in ozone levels leads to a three per cent increase in the incidence of non-melanoma skin cancer known as basal cell and squamous cell carcinomas. These cancers are not fatal if treated early.

However, an increase of UV-B radiation can also bring an increase in cutaneous malignant melanoma. Nearly 40 per cent of patients with melanoma die from the disease within five years. People with fair skin are particularly vulnerable to skin cancer because lighter skin has less melanin, which blocks out UV-B rays.

Eye Disease - UV-B can cause a variety of disorders from temporary "snow blindness" to permanent blindness, for example by damaging the retina.

UV-B radiation is a major cause of cataracts, a clouding of the eye's lens, which is a leading cause of blindness worldwide. A 1 per cent depletion of the ozone layer is estimated to increase the number of cataracts by 0.6 per cent, leading to 100,000 extra blind people. Corrective surgery to treat cataracts is often unavailable in developing countries.

Immuno-Suppression - Increased exposure to UV-B radiation causes suppression of the body's immune system, leading to increases in the occurrence or severity of infectious diseases. The effectiveness of vaccination programmes may also be reduced, placing immense strain on the already hard-pressed medical services in developing countries.

The skin is the body's first line of defence against many diseases and UV-B radiation reduces its ability to combat infection. Diseases which might be affected include viral diseases such as chicken pox,

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measles, and herpes; parasitic diseases which enter the skin such as malaria or leishmaniasis; bacterial infections such as tuberculosis and leprosy; and fungal infections like candiasis.

Agriculture

Crop Yield - About two thirds of the plant species investigated by the US Environmental Protection Agency are sensitive to UV radiation. Plants show reduced growth, smaller leaves, reduced nutritional value and increased susceptibility to disease when exposed to high UV concentrations.

The most sensitive plant groups include peas, beans, cabbage, and certain varieties of soybean and wheat. The 'fixing' of nitrogen, an important nutrient, in rice paddies is also impeded.

An increase of UV-B could reduce agricultural yields worldwide, creating food shortages. The impact would be greatest in those areas where undernourishment or famine are already a problem.

The Marine Environment

Increased UV-B radiation would damage aquatic organisms starting at the bottom of the food chain with small marine organisms such as phytoplankton, zooplankton, larval crabs, and juvenile fish. Damage to these organisms threatens animals all the way up the food chain from krill to marine mammals such as seals, whales and sea birds.

Commercial fish yields may fall, which is of particular concern to a number of developing countries. In many countries fish provides more than 50 per cent of dietary protein.

Material Degradation

Exposure to UV-B radiation is the main cause of degradation in many materials, particularly plastics that are used outdoors. Polymeric materials (plastics and rubbers) are widely used in both construction and agriculture, involving routine outdoor exposure. UV-B radiation causes photo-induced reactions which make exposed materials discoloured, brittle, and unusable.

Greenhouse Link

The destruction of the ozone layer is not the same as the greenhouse effect, but the two are linked in a number of ways. Ozone-depleting gases are responsible for 20-25 per cent of man-made global warming due to their heat-trapping properties.

The oceans absorb carbon dioxide, the main greenhouse gas, which is used by phytoplankton in photosynthesis. A reduction in phytoplankton due to increased UV-B radiation, could decrease the amount of carbon dioxide removed from the atmosphere, thereby adding to increased global warming.

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"H" CFCS: The Chemical Industry's New Ozone Destroyers

One of the most important criteria for CFC alternatives is that they shall not present unacceptable environmental risks, said a major CFC producer recently; no-one wants to "jump out of the frying pan into the fire" . FOEI wholeheartedly agrees, but views diverge from this point.

The CFC producers' favoured substitutes are a new generation of chemicals from the CFC family - hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs).

The HCFCs are often unhelpfully lumped together with HFCs under the broad heading 'HFAs', but require considerably more than a name-change to disguise their chlorine content. Their ozone depletion potentials range from 2-10% of that of the benchmark CFC 11. Already HCFC 22, increasingly used in refrigeration and some foam blowing applications, contributes 3% of the ozone-destroying chlorine in the atmosphere.

Moreover, both the HCFCs and HFCs are potent greenhouse gases. HFC 134a, the favoured substitute for refrigeration, is a quarter as powerful as CFC 11, HCFC 22 a third. UNEP estimates that they may contribute 2-10% of the global warming problem out to the year 2030.

In addition, fears have been voiced by some scientists that the likely breakdown products of some HCFCs and HFCs may include toxic monofluoroacetic acid. Research is underway to confirm or allay these concerns.

Ozone and Global Warming Potential of Fluorocarbons

Hydrochlorofluorocarbons	Ozone Depletion Potential % of CFC 11	Global Warming Potential % of CFC 11
HCFC 22	5%	32%-37%
HCFC 123	2%	1.7%-2%
HCFC 124	2%	9.2%-10%
HCFC 141b	10%	8.4%-9.7%
HCFC 142b	6%	34%-39%
HCFC 225ca	5%	n.a.
HCFC 225cb	5%	n.a.
Hydrofluorocarbons		
HFC 125	0	51%-65%
HFC 134a	0	24%-29%
HFC 143a	0	72%-76%
HFC 152a	0	2.6%-3.3%

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Effect of HCFCs on Ozone

The ozone depletion potentials of HCFCs are often compared to those of CFCs to show that they are much smaller. This completely misses the point. The stratosphere has very little tolerance of chlorine, however small the amount.

Limited use of HCFCs does not affect the date at which the Antarctic ozone hole is eliminated, but creates a plateau effect, keeping chlorine levels significantly higher for decades longer than if HCFCs were not used. Given the growing risk of severe Arctic ozone depletion, this is a high risk strategy. The problem is compounded if HCFCs with a higher rather lower ozone depletion potential are used.

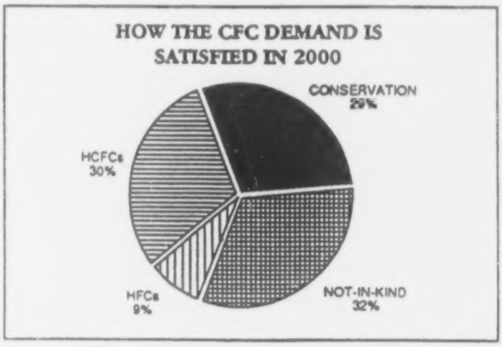
Part of the Solution or Part of the Problem?

The scientific case against ozone depleting chemicals is now overwhelming. There is a clear environmental imperative to avoid the introduction of any new ozone depleting chemicals. The HCFCs can only play an interim role where there is no other way of ending use of the more damaging CFCs rapidly - as UNEP's experts put it "They should be considered as options of last resort".

The key question, therefore, is to identify sectors where HCFC use is not needed. For other uses, an early phaseout date must be set, to give industry a clear signal that research and development into alternatives must be given the highest priority and that continued use of ozone-depleters is unacceptable.

Industry Uses of HCFCs

Industry estimates that HCFCs may take 30% of the current demand for CFCs by the year 2000 are a cause for great concern, and do not reflect the myriad of options already available to user industries. This market share must be restricted further, and a halt called now to the development of HCFCs with high ozone depleting potentials.



The chemical industry is showing signs of hedging its bets. Du Pont and ICI have both announced non-HCFC solvent alternatives, demonstrating company concern that HCFCs may capture a much smaller share of their historic markets than originally expected. Indeed, HCFC use is not required for solvents given the range of alternatives available, nor for aerosols, the vast majority of foam blowing, or a number of refrigeration uses.

Developing countries must also minimise HCFC use. The funding provided by industrialised countries should be allocated initially to non-fluorocarbon substitutes and emerging technologies. Neither environmental protection nor development will be helped by locking the South into new uses of chemicals which the developed world is attempting to rid itself of.

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The Need for Regulation

Governments plan to issue a declaration urging industry to use these chemicals responsibly. But it is optimistic in the extreme to assume that companies will voluntarily refrain from expanding sales of their new products and finding new markets or new uses.

The chemical industry has not given a commitment to avoiding the development of new uses for these substances. FOEI has already exposed producers who are marketing HCFCs for use in aerosols, including a wide range of personal care products which are currently ozone-friendly. HCFC 22 is currently used by some food packaging manufacturers. Many other user industries are poised to make vital investment decisions and are awaiting guidance as to which substitutes to turn to.

Against such a backdrop, a declaration, devoid of legislative force, will provide a weak and ineffective signal to industry.

National legislation is already beginning to step up the pressure. The US Congress has already voted for a phaseout of HCFCs in new uses by 2015 and by 2020 for the less damaging ones. West Germany intends to ban HCFC 22 before the end of the century. This month the Canadian House of Commons Environment Committee called for a 2010 ban.

The Nordic countries are pressing for inclusion of the HCFCs in the revised Montreal Protocol and for a phaseout date to be set by 2010-2020, and the US is proposing a phaseout for use in new equipment by 2020-2040. The EC is fiercely resisting such attempts, even the inclusion of HCFCs for the purposes of formal data reporting.

FOE International's Policy

Environmentalists have warned for some time that private investment into alternatives is disproportionately controlled by CFC producing companies, who are overemphasising the development of close variants of the current chemicals. Production processes and end-use applications which are less reliant on such chemicals are receiving short shrift.

FOEI is calling for an immediate ban on HCFCs in aerosols. HCFCs should be phased out in new equipment in 2005. Until then, use should be confined to essential applications where chlorine-free substitutes are not available, choosing those which contribute least to ozone depletion and global warming. Governments must act now to protect future generations from the effects of the new generation of ozone depleters.

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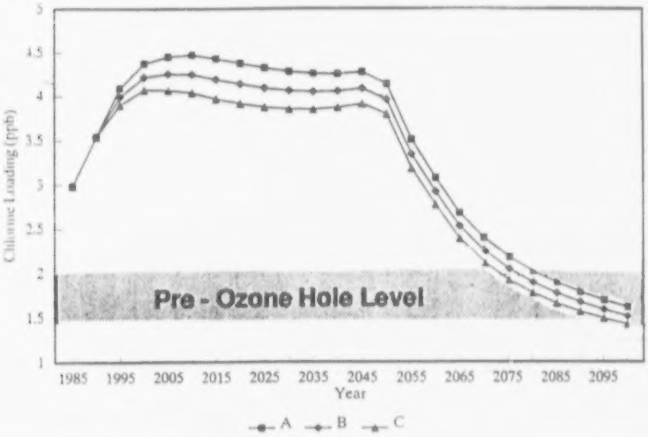
WHY WE NEED DEEP, EARLY CUTS IN CFC CONSUMPTION

The governments involved in the negotiations to revise the Montreal Protocol jointly agreed in Helsinki last year to phase out CFCs in the year 2000. As virtually all of these countries continue to support this position in the negotiations, the key debate has been over what interim steps should be taken to achieve this goal.

Friends of the Earth International has developed the following scenarios to demonstrate how important it is to make deep, early cuts in the production of CFCs. (All scenarios assume a phaseout of carbon tetrachloride in the year 2000, with methyl chloroform and the HCFCs both eliminated in 2050. Detailed assumptions are listed at the end of the briefing note)

CFC PHASEOUT SCENARIOS



Line A - The Common Ground for Likely Amendments

Line A is a rough approximation of the measures proposed by the Executive Director of UNEP. It does, however, match his proposal precisely with regard to CFCs, calling for a 20% cut in consumption in 1993, with an 85% cut in 1997 and a complete phaseout in the year 2000.

If governments settle upon such inadequate measures, the peak chlorine load in the atmosphere will reach almost 4.5 ppb - a 50% increase over today's levels - which greatly increases the risk of severe Arctic ozone depletion. The Antarctic

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ozone hole would be with us until at least 2080. Most distressingly, chlorine levels would remain above 4 ppb until 2050, exposing all of us to an extended period of severe ozone loss.

Line B - Phasing Out CFCs in 2000 With Tougher Interim Cuts

During the course of the negotiations to revise the protocol, the EC and the Nordic countries proposed that a CFC phaseout in 2000 be preceded by consumption cuts of 50% in 1992 and 85% in 1995. While this proposal has now been abandoned, the Nordic countries and others are now calling for a CFC phaseout in 1997. This position will only heighten the gains illustrated here.

Simply strengthening the interim cuts of a CFC phase out in 2000, will provide significant benefits to the ozone layer. The Antarctic ozone hole will disappear in 2075 - 5 years earlier than in the Executive Director's proposal. Peak chlorine loading in the atmosphere will be reduced to only 4.25 ppb.

Moreover, chlorine levels in the atmosphere would drop below 4 ppb before 2050, having been significantly lower than the previous scenario throughout the entire period. The risk of severe ozone depletion, in the Arctic and around the planet, will be slightly reduced.

These benefits cannot be ignored. Faster action on CFCs remains on the negotiating table. As many countires have demonstrated with their domestic action programs, such action is clearly possible. Governments must indicate that their concern for the ozone layer is more than rhetoric. The world needs deep, early interim cuts on the way to a rapid CFC phaseout.

Line C - A Rapid CFC Phase Out

Friends of the Earth International is campaigning for an international phaseout of CFCs in 1992. The benefits of such a rapid phaseout are obvious, as indicated by line C.

The Antarctic ozone hole will disappear just after 2070 in this scenario and the peak chlorine load will only be 4 ppb. More importantly, chlorine levels will drop below 4 ppb in 2015.

While it has been deeply disappointing to see very few countries call for a CFC phaseout before the year 2000 in these negotiations, it is clear that our message is being heard. Austria has announced it will eliminate 90% of its CFC consumption in 1993. West Germany has recently joined Sweden, Norway and Australia in agreeing to phase out 95%-100% of CFC consumption by 1995.

The member groups of Friends of the Earth International will continue to push for faster action on CFCs within their own countries and internationally after the ink has dried on the revised protocol in London.

ASSUMPTIONS

Line A:

* CFCs: freeze-1989; 20% cut-1993; 85%-1997; 100%-2000

Line B:

* CFCs: freeze-1989; 50% cut-1992; 85%-1995; 100%-2000

Line C:

* CFCs: phase out-1992

Shared by all lines:

* Carbon tetrachloride: freeze-1992; 85% cut-1995; 100%-2000
* Methyl chloroform: freeze-1992; 50% cut-2000; 100%-2050
* HCFCs: average ODP 0.04; 30% of CFC market; phase out-2050
* 100% global compliance with developing countries (15% of world consumption) having 10 extra years to comply

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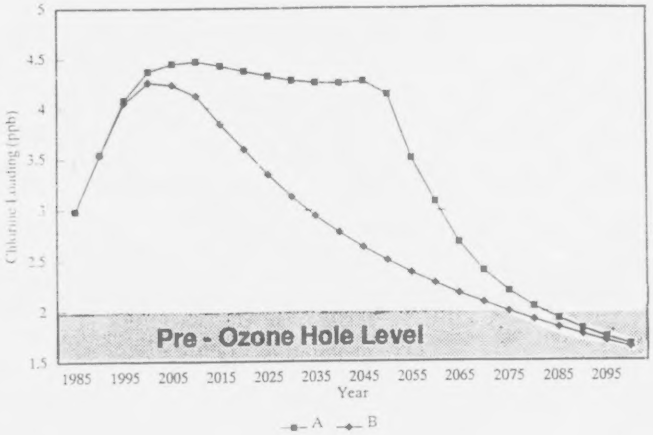
WHY THE MONTREAL PROTOCOL SHOULD RAPIDLY PHASE OUT METHYL CHLOROFORM AND THE HCFCs

It is now quite likely that the revised Montreal Protocol will not include a binding commitment by governments to phase out methyl chlorform and HCFCs. Many countries share the belief that because these chemicals have a low ozone depletion potential, their continued use will only result in a limited increase in atmospheric chlorine levels.

Nothing could be further from the truth. Friends of the Earth International has developed the following scenarios to illustrate that the continued use of these chemicals will cause substantial damage to the ozone layer. (Both scenarios assume a phaseout of CFCs and carbon tetrachloride in the year 2000. Detailed assumptions are listed at the end of the briefing note.)

HCFC AND METHYL CHLOROFORM PHASEOUT SCENARIOS



Line A - Phasing Out Methyl Chloroform and HCFCs in 2050

This line indicates what will happen if we delay a phase out of these low ODP ozone destroyers until the middle of the next century. Methyl chloroform is assumed to have a 50% production cut in 2000, while HCFCs with an average ODP of 0.04 are assumed to take 30% of the CFC market.

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If governments settle upon such inadequate measures, the peak chlorine load in the atmosphere will reach almost 4.5 ppb - a 50% increase over today's levels - which greatly increases the risk of severe Arctic ozone depletion. The Antarctic ozone hole would bve with us until at least 2080. Most distressingly, chlorine levels would remain above 4 ppb until 2050, exposing all of us to an extended perios of severe ozone loss.

Line B - Phasing Out Methyl Chloroform and HCFCs in 2010

The graph makes it very clear that placing stricter controls upon these low ODP chemicals provides dramatic benefits to the ozone layer. Methyl chloroform production is once again assumed to be halved in the year 2000 and HCFCs are assumed to have an average ODP of 0.02 while replacing only 10% of the CFC market. The assumptions for both types of chemical are very generous. We can end our use of these chemicals much more quickly and HCFC use should never reach 10% of the CFC market.

In this scenario, the peak chlorine load is only 4.25 ppb and the Antarctic ozone hole disappears by 2075. While these are significant improvements over the previous scenario, the key benefit is how quickly chlorine is eliminated from the atmosphere.

The more rapid phase out of HCFCs and methyl chloroform would return chlorine levels to 4 ppb in 2010 - a full 40 years earlier than in the previous scenario. Atmospheric chlorine returns to today's levels of 3 ppb in 2035 - 25 years earlier than in the previous case. Rapidly reducing the amount of chlorine in the atmosphere is the key to reducing the risk of severe ozone depletion in the world's non-polar regions.

A quick phase out of methyl chloroform and the HCFCs is the single most effective step we can take to rapidly decrease chlorine levels in the atmosphere. The atmospheric lifetime of these chemicals is much shorter than that of the CFCs, meaning they will be quickly cleansed from the atmosphere once they are banned.

Friends of the Earth International calls on governments to make a binding commitment to rapidly phase out methyl chloroform and HCFCs in this revision of the Montreal Protocol. The benfits to the ozone layer are obvious to all who are wiling to see.

ASSUMPTIONS

Line A:

* CFCs: freeze-1989; 20% cut-1993; 85%-1997; 100%-2000
* Carbon tetrachloride: freeze-1992; 85% cut-1995; 100%-2000
* Methyl chloroform: freeze-1992; 50%-2000; 100%-2050
* HCFCs: average ODP 0.04; 30% of CFC market; phase out 2050
* 100% global compliance with developing countries (15% of world consumption) having 10 extra years to comply

Line B:

* CFCs: freeze-1989; 20% cut-1993; 85% cut-1997; 100%-2000
* Carbon tetrachloride: freeze-1992; 85% cut-1995; 100%-2000
* Methyl chloroform: freeze-1992; 50% cut-2000; 100%-2010
* HCFCs: average ODP 0.02; 10% of CFC market; phase out 2010
* 100% global compliance with developing countries (15% of world consumption) having 10 extra years to comply

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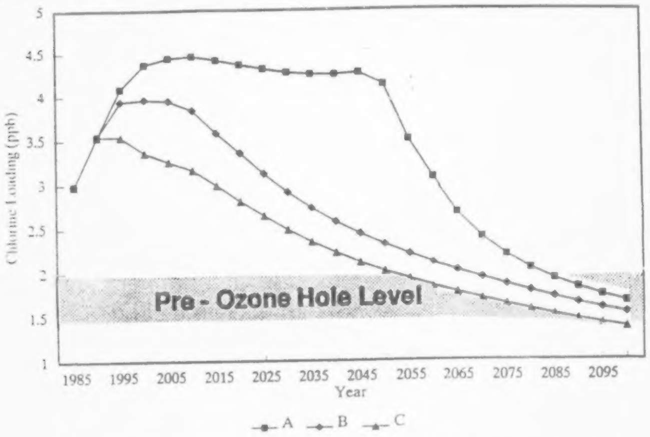
THE THREAT POSED BY A DAMAGING CONSENSUS

Many governments involved in the negotiations to revise the Montreal Protocol appear willing to accept the Executive Director's 'consensus' proposals for controls on ozone-depleting substances. Such a consensus is unacceptable. Friends of the Earth International has developed the following scenarios to demonstrate that these measures are inadequate to protect the ozone layer. (the assumptions underlying each scenario are presented in detail at the end of the briefing note)

PHASEOUT SCENARIOS FOR OZONE-DEPLETING SUBSTANCES



Line A - The Common Ground for Likely Amendments

Line A is a rough approximation of the measures proposed by the Executive Director. CFCs and carbon tetrachloride are phased out in the year 2000 and methyl chloroform production is halved at that time. The Executive Director has not proposed a complete phaseout of methyl chloroform or HCFCs. This scenario therefore assumes that production of these chemicals will continue until the middle of the next century in order to illustrate the effect of not controlling these chemicals more strictly in the protocol.

If governments settle upon such inadequate measures, the peak chlorine load in the atmosphere will reach alomst 4.5 ppb - a 50% increase over today's levels - which greatly increases the risk of severe Arctic ozone depletion. The Antarctic ozone hole would be with us until at least 2080.

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Most distressingly, chlorine levels would remain above 4 ppb until 2050, exposing all of us to an extended period of severe ozone loss.

Line B - The Toughest Positions Brought to the Table

The negotiations leading up to the London meeting have seen governments propose substantially tougher measures to eliminate ozone-destroying chemicals than those proposed by the Executive Director. Friends of the Earth International is extremely disappointed that virtually all of these positions have been abandoned by the governments that proposed them in an effort to reach a consensus.

Line B represents a combination of the toughest control measures that have been proposed for individual chemicals. It incorporates a phaseout of HCFCs in 2010 (Nordic countries), methyl chloroform in 2000 (Nordic countries, Australia, Canada), and carbon tetrachloride in 1995 (Nordic countries, Canada). CFCs are phased out in the year 2000 by the timetable once proposed by the EC and the Nordic countries; a 50% cut in 1992 and an 85% cut in 1995.

These stronger proposals would provide a significant benefit to the ozone layer if they were incorporated into the protocol. The Antarctic ozone hole would disappear in 2065, 15 years earlier than under the Executive Director's proposal. Peak chlorine loading would never exceed 4 ppb, reducing the risk of severe Arctic ozone depletion. Finally, the level of chlorine in the atmosphere would drop to today's level by 2015, substantially faster than would occur under the consensus threatening to overtake the conference.

Nations hold the future of the ozone layer in their hands at this London meeting. Simply moving to a consensus around the stronger control measures already proposed in these negotiations will have an extremely positive impact on that future. Anything less represents an admission by governments that they are willing to condemn future generations to the health risks posed by increasing levels of ultraviolet radiation.

Line C - Friends of the Earth International's Position

It is clearly possible for nations to do much more to protect the ozone layer. Friends of the Earth International has called for a phase out of CFCs, carbon tetrachloride and methyl chloroform in 1992. For the purposes of this scenario, FOEI has assumed that HCFCs will be eliminated in 2010. It will be possible, however, to move away from these chemicals at a more rapid rate.

Under this stringent programme, the Antarctic ozone hole is eliminated in 2050 - 30 years earlier than in the Executive Director's proposal. Peak chlorine levels never exceed 3.6 ppb. They actually begin to decline before the year 2000, setting the ozone layer on the road to recovery.

Friends of the Earth International is deeply disappointed that no government has put forward such progressive proposals. Our member groups around the world will continue to push for such measures within their own countries and internationally after the ink has dried on the revised protocol in London.

ASSUMPTIONS:

Line A:

* CFCs: freeze-1989; 20% cut-1993; 85% cut-1997; 100%-2000
* Carbon tetrachloride: freeze-1992; 85%-1995; 100%-2000
* Methyl chloroform: freeze-1992; 50%-2000; 100%-2050
* HCFCs: average ODP 0.04; 30% of CFC market; phase out-2050
* 100% global compliance with developing countries (15% of world consumption) having 10 extra years to comply

Line B:

* CFCs: freeze-1989; 50% cut-1992; 85%-1995;100%-2000
* Carbon tetrachloride: freeze-1992; phase out 1995
* Methyl chloroform: freeze-1992; 50% cut-1995; 85%-1997;100%-2000
* HCFCs: average ODP 0.04; 25% of CFC market; phase out 2010
* 100% global compliance with developing countires (15% of world consumption) having 10 extra years to comply

Line C:

* CFCs: freeze-1989; phase out-1992
* Carbon tetrachloride and methyl chloroform: phase out-1992
* HCFCs: average ODP 0.02; 10% of CFC market; phase out 2010
* 100% global compliance with developing countries (15% of world consumption) having 5 extra years to comply

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THE HALON THREAT: GOVERNMENTS POISED TO ALLOW FURTHER EMISSIONS EQUAL TO 50% OF HISTORIC PRODUCTION

The amount of halons 1301 and 1211 which could be produced before a production phaseout could be over 50% of the total amount of halons produced to date.

The halons have ozone depletion potentials of 3-10 times that of the benchmark CFC 11. Worse, the bromine released into the stratosphere from halons reacts synergistically with chlorine.

The compromise proposal generally accepted by delegates present will freeze halon production by 1992, reduce it by 50% by 1995 and then phase out production by 2000. It is unacceptable for governments to sanction the intolerable added burden on the fragile ozone layer, which would allowed. Governments should urgently review the proposals on the table.

Production of Halons 1301 and 1211 (1970-89)

1301	1211
107,526 tonnes	177,175 tonnes

Total 284,701 tonnes

Total Production Allowed By Revised Montreal Protocol

1990-1992 Predicted Production	1301	1211
	11,289 +	18,044 +
	10,576	16,947
Total	21,865	34,991
1992-1995 Frozen Production		
	9,862 x 3 =	15,851 x 3 =
Total	29,586	47,553
1995-2000 - 50% Cut		
	4,931 x5	7,925.5 x5
Total	24,655	39,627.5
Total	76,106	122,171.5

Grand Total 198, 277.5 tonnes

Source for raw data: Halon Fire Extinguishing Agents Technical Options Report, UNEP, June 1989

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Ms. COOK. Governments at the London meeting made significant progress in amending the Montreal Protocol. Parties to the agreement established an interim financial mechanism to transfer ozone protecting technologies to developing countries and they widened the scope of controls on ozone destroying chemicals. Friends of the Earth is very encouraged that the details of the financial mechanism sufficiently satisfied developing country concerns to prompt Indian and Chinese delegates to recommend to their governments to ratify the pact.

Friends of the Earth looks forward to evaluating whether the ozone fund meets the challenge of providing developing countries with environmentally sound technologies, as well as serve to build cooperation between the North and South on environmental protection. We are, however, very concerned that the London agreement falls short of taking all the actions necessary to stop ozone depletion, and that it lacks a sense of urgency, which the seriousness of the ozone problem requires.

In my statement today, I will summarize three concerns we have about the outcome of the Second Meeting of the Parties to the Montreal Protocol. Finally, I will touch on some of the criteria we believe is necessary for successful implementation of the Montreal Protocol funding mechanism.

Mr. Boehlert touched on some of our concerns already, and I would like to respond to the dialogue that ensued. Our first concern is that very dangerously slow timetables have been set on the phase-out of CFCs, halons, carbon tetrachloride and methyl chloroform. We commend the parties to the Protocol for agreeing to phase out these chemicals, however, we believe that the slow timetables unnecessarily increase the risk of ozone depletion.

Dr. Watson told us that under the agreement made in London, chlorine levels will increase from today's levels of 3.5 parts per billion to over 4 to 4.5 parts per billion. We know that today's levels are already unacceptably high. We don't know what will happen if levels increase to 4.5, but what we do know is the faster we take action to reduce and eliminate these chemicals, the faster the chlorine levels will decline.

The importance here is that short-lived chemicals like methyl chloroform—the faster you eliminate them, the faster you reduce the peak loading of chlorine in the stratosphere. That is directly linked to the risk of severe Arctic ozone depletion. The faster we move to eliminate the longer-lived chemicals, the sooner we can recover the Antarctic ozone hole.

I think the important thing to stress about the difference between giving industry ten years to phase out CFCs and if countries would have adopted the strongest position on the table, is that it not only would have phased out CFCs in the year 1997, but would have had deep interim cuts. Under the current amendment, industry will be permitted to continue producing, between now and the year 2000, 10 billion pounds of CFCs. If the fastest timetable were adopted, they would instead only be producing 6.6 billion pounds of CFCs. I am not sure whether or not Dr. Watson's analysis of the difference between 1997 and the year 2000 included the deeper and faster interim cuts that were also on the table with that faster proposal.

Our second concern is that the Administration, the U.S. policy, did not support all the strongest positions on the table. Clearly, the 1997 proposal is the one we are referring to here. It is important to stress how great a role the United States has in these negotiations. The United States, toward the end of the meeting, supported a phase-out of methyl chloroform. I believe that that did move the parties at the Montreal Protocol negotiations to phase out methyl chloroform. If the United States did not put its support behind that phase-out, we would probably only have today an amendment calling for a 50 percent cut by the year 2000.

Given the importance of the U.S. role in the negotiations, we are disappointed that the U.S. did not support all of the toughest measures and a faster timetable for CFCs. Several different countries are committed to phasing out 90 to 100 percent of CFCs by the year 1995. West Germany will plan to do this by 1995 entirely. We must ask the question, what is the difference between our economy and that of West Germany?

The final point I want to make about that is that if we don't push our industries to move very quickly, we may indeed create a climate where other industries in other countries are at a competitive advantage over United States industries.

Our final concern is that HCFCs were left entirely out of the agreement. We know, as Dr. Watson said, 'unless there are strict controls on HCFCs, our Antarctic ozone hole will never recover. The non-binding resolution that the countries agreed to is essentially a green light to industry to develop a new generation of ozone destroyers and to use them as it pleases.

Industry's estimate that HCFCs, these substitutes, will replace 30 percent of the CFC market is a cause for concern. Given the large cost of commercializing these chemicals, it would suggest to us that they will indeed want to expand their markets. We have evidence, for example, that Dupont is marketing widely now the use of HCFCs in aerosol applications ranging from deodorants to shaving creams.

Our position is that HCFCs should be banned immediately for the use in aerosols except for medical applications, and that a very clear early phase-out date should be set. In this regard, we urge Congress to retain the HCFC phase-out provision in the Clean Air Act. It sets a date certain for the phase-out, and as we heard today, the Administration policy at London was to support an HCFC phase-out. We hope that they will put their support behind the provisions in the Clean Air Act to phase out HCFCs. This would give the United States an opportunity to show leadership in an important area where parties to the Montreal Protocol have failed.

Lastly, I want to comment on the funding mechanism that was established in London. It clearly sets a precedent for cooperation globally in environmental protection, but the success of this fund will depend on the ability of it to ensure the transfer of technology and to develop a trusting relationship between industrial and developing nations.

We now know that global cooperation in the Montreal Protocol is more likely because of this funding mechanism. But the negotiations were marred by a sense of mistrust between developing countries and industrialized nations. Developing nations were uncertain whether or not technology will be made available, and the U.S. conditionality in its position was referred to as a sort of colonialism.

The challenge of this new mechanism is to allay these sentiments that the developing countries have, and to ensure that technology is transferred and that funds are provided in addition to existing development aid. We are very optimistic that the United States will play a very constructive role in technology transfer. The recent difficulty, caused by the U.S. position first to oppose the fund, and then to have conditions attached to it, has clouded the positive contribution that U.S. officials, specifically the EPA, have made in contributing to progress on establishing the funding mechanism.

Elements of the mechanism established—most of them were originally U.S. proposals, and many of the case studies that EPA has been involved in have helped to provide estimates on how much money will be needed.

Lastly, the most important challenge that this financial mechanism faces is to ensure that all available alternatives are looked at and considered in the transfer of technology. An overemphasis should not be placed on HCFCs, which are still damaging to the ozone layer, and may not, in all cases, be necessary. We believe that the fund should not be used to transfer a new generation of ozone destroyers where chlorine- free alternatives are available. Congress can play a role in this process by helping to divert some of the revenue from the tax on ozone-depleting chemicals to the research and development of completely ozone-safe technologies.

I thank the committee for allowing us to present our views today, and would be happy later on to answer any questions you may have.

Thank you.

[The prepared statement of Ms. Cook follows:]

FRIENDS OF THE EARTH
Environmental Policy Institute
OCEANIC SOCIETY

Testimony of Liz Cook
Ozone Campaign Director

of

Friends of Earth

before the

Natural Resources, Agricultural Research, and Environment
and
International Scientific Cooperation
Subcommittees of the
Committee on Science Space and Technology
U.S. House of Representatives

July 11, 1990

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Chairmen and Members of the Subcommittees:

I am Liz Cook, Ozone Campaign Director of Friends of the Earth. We are the U.S. affiliate of Friends of the Earth International, a worldwide environmental network with member organizations in 37 countries. My statement this morning is made on behalf of the 45,000 members and supporters of our global advocacy group.

We greatly appreciate your invitation to appear here this morning to share our views on the outcome of the Second Meeting of the Parties to the Montreal Protocol, which took place June 27-29 in London. I had the privilege of observing this important conference as part of the Friends of the Earth International Delegation. Our delegation included representatives of Friends of the Earth groups in Argentina, Canada, Indonesia, West Germany, the United Kingdom, and the United States.

Background

FoE International's work to protect the ozone layer dates back to the early 1970's, when FoE groups in the U.S., France, and the United Kingdom coordinated efforts to stop construction of a commercial fleet of supersonic transport jets which threatened the ozone layer.

Since nations negotiated the Montreal Protocol in September 1987, the FoE International network has made ratification and strengthening of the agreement a top priority. FoE ozone layer specialists have pressed for strong governmental action at the First Meeting of the Parties of the Montreal Protocol in Helsinki and at many of Montreal Protocol working group meetings leading up to the recent London meeting. In order to keep the public informed of global efforts to stop ozone depletion, we publish Atmosphere, a quarterly publication on ozone protection.

FoE has supplemented its international effort with domestic campaigns in many countries aimed at reducing the use of ozone-depleting chemicals and establishing strong national government ozone protection plans. In the United States, for example, FoE has campaigned for mandatory CFC recycling at automobile service shops to minimize CFCs emissions from mobile air conditioners, the nation's largest source of ozone-destroying pollution. We are also urging Congress to enact tough controls on ozone-depleting chemicals as part of the Clean Air Act reauthorization.

The London Meeting

Governments at the London meeting made significant progress in amending the Montreal Protocol. Parties to the agreement established an interim financial mechanism to transfer ozone-protecting technologies to developing countries and they widened the scope of controls on ozone-destroying chemicals.

Friends of the Earth is very encouraged that details of the financial mechanism sufficiently satisfied developing country concerns to prompt Indian and Chinese delegates to recommend that their governments ratify the pact. FoE looks forward to evaluating whether the ozone fund meets the challenge of providing developing nations with the most environmentally-safe technologies available, as well as serving to build cooperation between North and South on environmental protection.

Friends of the Earth, however, is extremely concerned that the London agreement falls short of taking all the actions necessary to stop ozone depletion and that it lacks a sense of urgency which the seriousness of the ozone problem requires.

We have the following concerns about the outcome of the Second Meeting of the Parties to the Montreal Protocol:

1. The agreement includes dangerously slow timetables for the phaseout of CFCs, halons, methyl chloroform, and carbon tetrachloride.

2. The United States Administration did not demonstrate clear leadership and was not among the governments advocating all of the strongest amendments to the Montreal Protocol.

3. The parties set no controls on ozone-depleting substitute chemicals known as HCFCs.

Dangerous Timetables

The London agreement allows industry to continue producing CFCs, halons, and carbon tetrachloride until the year 2000, and methyl chloroform until the year 2005. These slow timetables unnecessarily increase the risk of ozone depletion.

Parties to the Montreal Protocol must be commended for agreeing in London to phase out production of several ozone-destroying chemicals, especially methyl chloroform, a chemical which many governments previously did not want to eliminate. Unfortunately, though, the Parties have set dangerously slow timetables for the phaseout of CFCs, halons, methyl chloroform, and carbon tetrachloride.

Governments have given industry ten to fifteen more years to continue producing these destructive compounds. Over this period chemical manufacturers will produce approximately ten billion more pounds of CFCs (505 percent of the amount produced in 1986) and more than 50 percent of the total amount of halons produced to date. Individual governments and companies which use these chemicals are showing that much faster action can be taken to eliminate these chemicals and decrease the quantity of ozone-destroying chlorine and bromine emitted to the atmosphere.

Minimizing emissions of ozone-destroying compounds is extremely important. Levels of chlorine and bromine in the atmosphere are already unacceptably high, causing ozone holes over the North and South Pole and deterioration of the global ozone layer. With the timetables set in London, chlorine is likely to rise from current levels of 3.0 parts per billion (ppb) to over 4.0 ppb - an unprecedented amount. Scientists are unable to predict with certainty the consequences of such high levels, but they are confident that the faster chlorinated compounds are eliminated, the quicker chlorine levels will decline.

Because of the large quantities of methyl chloroform used and its relatively short lifetime, the U.S. Environmental Protection Agency has said that "...a phaseout of methyl chloroform would be the single most important source for near term reductions in stratospheric chlorine concentrations." Quickly reducing chlorine levels through a more rapid phaseout of methyl chloroform than the year 2005 would effect how high the peak level of chlorine rises and is the key to reducing the risk of more severe Arctic ozone depletion.

Setting timetables faster than the year 2000 for the phaseout of longer-lived chemicals, such as CFCs and carbon tetrachloride, directly influences how quickly chlorine concentrations will drop below 1.5 to 2.0 parts per billion, the level which scientists believed triggered the Antarctic ozone hole. New findings of worsening ozone depletion should sound an alarm which moves governments much faster to phaseout ozone-depleting chemicals. Sadly, the agreement reached in London lacks the required sense of urgency.

U.S. Position: Not the Toughest

In London, several governments pressed for a CFC phaseout in 1997 instead of the year 2000. The U.S. joined Japan and the Soviet Union in preventing agreement on the faster CFC phaseout. Progressive governments are unilaterally setting rapid phaseout schedules.

An Australian government representative reminded delegates at the London meeting that a sense of urgency was absent from the negotiating room. His government was particularly concerned because its region of the Southern Hemisphere has experienced some of the highest levels of ozone depletion to occur over populated areas. As a result, Australia joined New Zealand, and Norway in proposing a faster CFC phaseout timetable, including a 50 percent cut in 1993, an 85 percent cut in 1995, and a total phaseout in 1997. Compared to the final CFC agreement which allows industry to produce an additional 10 billion pounds of CFCs worldwide, this timetable would allow 6.6 billion pounds to be produced - significantly less.

The United States remained firm on its support for a slower CFC phaseout. Lack of U.S. support for tougher action is inexplicable. U.S. EPA Administrator Reilly informed the meeting that the U.S. has already cut CFC production 15-20 percent below 1986 levels. Several governments, including Sweden, Norway, West Germany, Australia, Switzerland, and Austria, are committed domestically to cutting CFC use 90 to 100 percent by 1995. At the end of the London meeting thirteen nations issued a statement declaring they will phase out CFCs as quickly a possible but not later than 1997.

If industrial countries, such as West Germany, can eliminate CFC production by 1995, why cannot the United States? West German Environment Minister Klaus Topfer stated the situation clearly in a June 30th Washington Post article. "I am absolutely convinced that if you give a clear cut timetable, it will stimulate industry to come up with substitutes. But if more time is allowed, I really believe they will take more time." In addition losing the environmental benefits of faster action, the U.S. "go slow" approach may create a climate in which U.S. industries may fall behind other nations in the race to develop alternatives to CFCs.

The importance of the United States' role in the Montreal Protocol negotiations cannot be understated. Just as U.S. position on CFCs held back an agreement to move more rapidly, an eleventh-hour shift in the U.S. position on methyl chloroform had a significant impact of moving Parties to agree on phasing out the chemical. Throughout most of the meeting the U.S. supported the UNEP Executive Directors's proposal to cut methyl chloroform production by 50 only percent by 2000. Without U.S. support for the full phaseout, the Parties would have likely only agreed to a 50 percent cut.

Congress deserves substantial credit for influencing the London outcome on methyl chloroform. Both Houses voted overwhelmingly with the Clean Air Act to eliminate this chemical, sending a signal to U.S. negotiators that Congress wants this action taken. The U.S. EPA has concluded that industry can replace existing methyl chloroform uses can by the year 2000. While Friends of the Earth, believes a phaseout can happen even faster (West Germany plans to phase out methyl chloroform in 1992), we urge Congress to enact a Clean Air Act which eliminates methyl chloroform by the year 2000 instead of waiting until 2005.

Given United States' power to influence the Montreal Protocol negotiations, FoE is disappointed that the U.S. delegation failed to show clear leadership in London by supporting all of the strongest proposals on the table to protect the ozone layer.

No Controls on HCFCs

In London governments agreed to phase out some, but not all of the chemicals which harm the ozone layer. They decided not to include substitutes called HCFCs in the revised Montreal Protocol. Scientists say excessive use of HCFCs could prevent recovery of the Antarctic ozone hole.

The most discouraging aspect of the London agreement is the failure of Parties to amend the Montreal Protocol to set controls on and eventually phase out production of substitute chemicals known as hydrochlorofluorcarbons (HCFCs). If the use of HCFCs is not strictly limited, ozone depletion will continue.

The CFC industry is developing a family of HCFCs to replace CFCs in a variety of applications. Some HCFCs, such as HCFC-22, are already in wide use today. These chemicals, which contain a hydrogen atom, break down more easily in the lower atmosphere and have less ozone-depleting potential. But they also contain chlorine and are not environmentally benign chemicals. The various HCFCs have anywhere from 2 to 10 percent of the ozone-depleting strength of the most commonly used CFCs.

U.S. EPA and UNEP studies show that the only way to return chlorine to pre-Antarctic ozone hole levels is to require strict limits on use of HCFCs. In these scenarios, HCFCs capture 20 percent of the CFC market and have 98 percent less ozone depleting potential than current CFCs.

In London, governments passed a non-binding resolution which includes guidelines for the use of HCFCs. They resolved to monitor the use of HCFCs with a view to replace them with non-ozone depleting alternatives by 2040 and, if possible, no later than 2020. By not including a binding HCFC phaseout among the protocol amendments, governments have given industry a green light to develop and use a whole new generation of ozone-destroyers.

According to industry estimates, HCFCs may take 30 percent of the current demand for CFCs by the year 2000. This is a cause for great concern. The large cost associated with commercializing these chemicals suggests that firms will seek to expand their markets. Indeed, Friends of the Earth has evidence that companies are already marketing HCFCs for applications where completely ozone-safe alternatives exist. Du Pont, for example, is pushing sales of DYMEI a line of aerosol propellants, which includes HCFCs, for use in hairsprays, deodorants, colognes, and several other applications.

Friends of the Earth advocates an immediate ban on HCFCs in aerosols (except for essential medical uses.) We believe governments should phase out HCFCs for use in new equipment by 2005 and existing equipment by 2010. Until then, industry should be required to confine HCFCs use to essential applications where chlorine-free substitutes are not available, choosing those which contribute least to ozone depletion and global warming.

Controls such as these would permit certain CFC users to switch to less-damaging HCFCs, but would prevent excessive HCFC use. Setting a definite phaseout date as early as 2010 also gives both users and chemicals producers a clear signal that HCFC substitutes are not a long-term solution. The goal must be to develop completely ozone-safe alternatives.

Strict limits on the use of HCFCs will encourage industry to search for alternatives outside the fluorocarbon family. In fact, many industrial sectors are finding innovative ways to replace ozone-destroying chemicals already. Several makers of flexible, soft foams now use water or alternative technologies to puff their product. In addition, companies that use CFC solvents are a turning to water-based solvents and new processes that require no solvents at all.

We urge Congress to retain the provisions of the Clean Air Act Amendments that will phase out HCFCs by a date certain. Both the House and Senate have shown foresight and environmentally sound judgement by voting to set dates by which industry must end HCFC production. If Congress stands by its HCFC decisions, it will show that the United States is willing to demonstrate leadership in an important aspect of ozone protection where Parties to the Montreal Protocol have failed.

Ozone Fund Challenges

Establishment of a funding mechanism to enable developing countries to participate in the Montreal Protocol sets a groundbreaking precedent in the area of global environmental cooperation. Success of the fund will depend on its ability to ensure the transfer of ozone-safe technology and develop a trusting relationship between industrial and developing nations.

Scientific analysis demonstrates that efforts to save the ozone layer will be doomed unless all nations agree to participate in the Montreal Protocol. Agreement in London to establish a funding mechanism to help developing countries implement the protocol greatly increases the chances of achieving global adherence to the pact.

Negotiations on the fund, however, were marred by a feeling of mistrust between industrialized and developing nations.

Developing nations expressed willingness to take measures to preserve the ozone layer, but voiced concern that they are being asked to abandon CFC-based technologies without certainty that they will gain ownership of new technologies. Without access to new technologies, these governments believe they would have to depend on industrial nations to supply them with CFC alternatives at a higher cost. Developing nations do not wish to clean up a problem primarily caused by the industrial world at the expense of their own economic development.

Governments welcomed the United States Administration's decision to reverse its position and support creation of a fund. But the number of U.S. conditions concerning its involvement in the fund's management was described by one developing country representative as a "positive idea, but a negative attitude." A Malaysian delegate referred to this U.S. conditionality as a form of "environmental colonialism." The funding mechanism has a challenge to allay these developing country sentiments. The funding mechanism must ensure that ozone-safe technologies are made available and that the costs of complying with the Montreal Protocol are covered by funds in addition to existing development aid.

Friends of the Earth is optimistic that the United States can play a constructive role in efforts to transfer ozone-safe technology. The recent difficulties caused by the Administration's opposition to the fund and subsequent conditionality has unfortunately clouded over the positive contribution U.S. officials, in particular EPA representatives, have made toward establishing the protocol's funding mechanism.

Less than a year ago, a very large gap existed between developing country demands for a fund within UNEP and donor nation insistence on using existing lending institutions to finance technology transfer. Many of the elements of interim funding mechanism originated with U.S. proposals. Additionally, case studies sponsored by the EPA to evaluate the costs of implementing the Protocol in Mexico, Egypt, and Brazil, have helped governments make initial estimates of the amount of funding required.

The most important challenge the funding mechanism faces, however, is to make information available about all possible alternatives to ozone-depleting chemicals. Investment into alternatives is disproportionately controlled by CFC producing companies, who are overemphasizing the development of close variants of the current chemicals. Production processes and end-use applications which are less reliant on HCFCs often receive short shrift.

Funds should not be provided to sell the new generation of ozone-destroyers for applications where an ozone-safe alternative is available. Given the availability of chlorine-free alternatives for many CFC applications, a shrewder long term strategy would be to provide these alternatives wherever possible. Otherwise, developing countries risk getting locked into uses of HCFCs which the industrialized world may soon abandon.

The U.S. Congress can help in this effort by taking steps to divert income generated from the tax on ozone-depleting substances to a program which provides research grants to companies which search for completely ozone-safe alternatives.

Finally, Friends of the Earth regrets that governments did not agree to make contributions to the fund obligatory and based on a polluter pay principle. Instead donor nations will be asked to voluntarily contribute to the fund based on a UN assessment scale.

FRIENDS OF THE EARTH
Environmental Policy Institute
OCEANIC SOCIETY

September 27, 1990

The Honorable James H. Scheuer
Chairman
Subcommittee on Natural Resources,
  Agriculture Research, and Environment
U.S. House of Representatives
Washington, DC 20515

Dear Representative Scheuer,

Friends of the Earth is grateful for the opportunity to have testified before your subcommittee on July 11th regarding our views on the revised Montreal Protocol on Substances that Deplete the Ozone Layer. Additionally, we welcome the follow-up questions in your letter dated August 13th and hope that this response will adequately answer them.

1. Will Friends of the Earth continue to follow the international processes associated with the Montreal Protocol? Will it also follow activities associated with the broader problem of "Greenhouse gases?"

Friends of the Earth will continue to follow the international processes associated with the Montreal Protocol. Parties to the protocol will assess the agreement's control measures again in 1992. We look toward this assessment as an opportunity for governments to hasten the timetables under which they will phase out ozone-depleting chemicals and to add substitute chemicals, called HCFCs, to the list of controlled chemicals.

In the short-term, we intend to monitor the activities of the Montreal Protocol ozone fund. Our efforts, however, have been stifled by a recent decision to barr non-governmental observers (NGOs) from the first meeting of the executive committee which will oversee the fund's allocations. Friends of the Earth has protested this decision. Enclosed is a copy of a letter we have sent to EPA Administrator Reilly asking him to press the committee's chairman to open Executive Committee meetings to NGOs and outlining the reasons we believe it is important for us to participate.

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Friends of the Earth also works on the broader problem of greenhouse gases. We have observed several meetings of the Inter-governmental Panel on Climate Change (IPCC) and are working with other environmental groups to encourage international action to halt global warming. In order to ensure that one environmental problem does not replace another, FoE plans to campaign with our international affiliates to prevent industry from switching to CFCs substitutes with high global warming potentials.

2. You mentioned in your testimony that Friends of the Earth has affiliates in other countries. Which of these affiliates are associated with less developed nations of the world?

The Friends of the Earth International network has member groups in forty-one countries. Seventeen of our affiliates are based in less developed nations including: Argentina, Bangladesh, Brazil, Burkino Faso, Chile, Cyprus, Dutch Antilles, Ecuador, Ghana, Indonesia, Malaysia, Nicaragua, Pakistan, Papua New Guinea, Sierra Leone, Tanzania, and Uruguay.

3. For future reference, does Friends of the Earth collect data or maintain a particular level of expertise on Third World environmental issues?

Several staff members at Friends of the Earth have expertise in Third World environmental issues. In particular, the following program areas may be of interest for future reference: tropical deforestation, hazardous waste export, international ocean policy, chemical plant safety, and our Central America Project. We are especially active in efforts to reform the lending policies of the World Bank, the International Monetary Fund, and the Asian Development Bank - aiming to make the projects funded by these institutions more environmentally sound.

If you need further elaboration on this information regarding Friends of the Earth's projects, please let me know.

Sincerely,

Cook

Liz Cook
Ozone Campaign Director

FRIENDS OF THE EARTH™
Environmental Policy Institute
OCEANIC SOCIETY

September 26, 1990

The Honorable William K. Reilly
Administrator
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

Dear Mr. Reilly,

Friends of the Earth is deeply concerned that non-governmental observers were barred from the first meeting of the executive committee overseeing the allocation of the new international fund to help developing countries meet their obligations under the Montreal Protocol on Substances that Deplete the Ozone Layer. The meeting was hosted by the Canadian government in Montreal on September 19-21.

As a member of this committee, the United States must work to convince the committee's chairman, Finnish diplomat Ilkka Ristimaki, that such a policy is inappropriate and unacceptable.

The United Nations Environment Program, under whose auspices the Montreal Protocol was negotiated, has traditionally granted non-governmental groups observer status at international negotiations concerning the ozone layer. This practice has enabled Friends of the Earth to stay well informed about the ozone issue and allowed us to make a real and meaningful contribution to efforts to end ozone depletion.

Negotiations over international policy to protect the ozone layer will continue within the committee overseeing the fund. The revised Montreal Protocol defines three of the functions of this committee as follows:

> * to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources.
>
> * to develop the criteria for project eligibility and guidelines for the implementation of activities supported by the multilateral fund.
>
> * to consider, and, where appropriate, approve country programs for compliance with the protocol and, in the context of those country programs, assess and, where appropriate, approve all project proposals or groups of project proposals where the agreed incremental costs exceed $500,000.

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Clearly, the executive committee will play a role in determining what substitute chemicals and processes developing countries will use to phase out ozone-destroying chemicals controlled under the protocol.

This is critically important precisely because there will often be a range of substitutes available. Some of them will have significant negative environmental consequences. Choices will have to be made. Friends of the Earth believes it is important that these discussions are carried out in a democratically open and accountable fashion.

Access to these meetings is also important to Friends of the Earth because the Montreal Protocol's financial mechanism is a landmark achievement which sets a clear and important precedent for future international agreements to counter global warming and preserve the world's vanishing biodiversity.

As the first agreement of its kind, the Montreal Protocol funding mechanism is an important test case. Improving and modifying this model in the year's ahead will require careful scrutiny of the mechanism's strengths and weaknesses. Both governmental and non-governmental sectors must be involved in this process.

The United States government has traditionally worked to encourage non-governmental participation in international negotiations on ozone; the EPA's Stratospheric Ozone Protection Advisory Committee is evidence of this effort. Friends of the Earth urges you to insist upon these principles within the fund's activities as well.

Friends of the Earth-Canada, our Canadian affiliate, has written to express our concerns directly to Mr. Ristimaki and UNEP Director Mostafa Tolba. We look forward to your response.

Sincerely,

Liz Cook

Liz Cook
Ozone Campaign Director

Mr. Scheuer. Thank you very much.

Now we will hear from Mr. Kevin Fay, Alliance for Responsible CFC Policy.

STATEMENT OF KEVIN J. FAY, EXECUTIVE DIRECTOR, ALLIANCE FOR RESPONSIBLE CFC POLICY

Mr. Fay. Thank you, Mr. Chairman.

Good morning, my name is Kevin Fay, and I am the Executive Director of the Alliance for Responsible CFC Policy. The Alliance is a coalition of CFC user and producer industries in the United States. We have participated in all the negotiating sessions leading up to the Montreal Protocol and through its subsequent revision.

We appreciate the opportunity to appear before your subcommittee to discuss the strengthening of the Protocol and the importance of technology transfer in order to ensure its effectiveness.

In 1987, it became apparent that the Protocol was a remarkable achievement that would require enormous effort in order to achieve its full potential. Now, after the London meeting, it is apparent that the Protocol process can and will work. It is incumbent upon us all, policy makers in the U.S., and industries that are being asked to produce the technological solutions, to continue to strive to make this process work.

We believe that the new control schedule adopted in London attempts to strike the proper balance towards achieving the rapid phase-out of the CFC compounds, while taking into account the availability of safe substitutes and the needs of existing installed equipment. It also establishes a reasonable posture with respect to the substitute compounds currently under development, particularly the HCFC compounds. Both elements are critical to encouraging maximum participation by all nations, developed and less developed.

The parties also agreed to language that would facilitate the provision of technical and financial assistance to developing countries. This language is very important to give further encouragement and inducements to these nations to participate in the Protocol process. The combination of the creation of a funding mechanism to assist developing countries that are party to the Protocol, so-called Article 5 countries, and the sanctions for non-compliance, should provide sufficient incentives to ensure participation by key developing countries.

In order for this process to work effectively, the U.S. and other developed countries will need to create and maintain a stable regulatory environment that will facilitate the development of the needed new technologies. We also will need to ensure that the Protocol is enforced fairly throughout the world, so that no nation is allowed to gain an unfair competitive advantage at the expense of other nations, or at the expense of the ozone layer.

Technology transfer to developing countries was a key issue, but not very well understood. It is clear, though, that the issue had to be resolved. Less developed countries represent a small portion, only 15 percent, of the current world's CFC demand. Of that percentage, approximately two-thirds of the LDC usage is by nations not party to the Protocol.

It is expected that the LDCs could represent up to 35 percent of the demand for substitute compounds by the year 2030. If instead of switching to HCFCs, the LDCs were to decide to continue using CFCs until 2015, atmospheric chlorine would still be close to 4 parts per billion in the year 2100. Assuming 100 percent participation of Protocol, however, we believe that atmospheric chlorine concentrations will peak at approximately 4 parts per billion, and be reduced to less than 2 parts per billion by the year 2070.

It is imperative that we encourage these LDCs to switch to non-CFC technologies as soon as possible, and not encourage them to wait until the period has ended for their special use exceptions.

Technology transfer was viewed during the discussion as a broader geopolitical issue. In reality, technology transfer occurs all the time in our economy, as a means of expanding product usage and marketing. The process is not all that different in this instance, save for the overriding environmental objective we are striving to achieve.

In our view, the technology transfer will occur naturally. During the Protocol negotiations, however, it was used as a surrogate to achieve other purposes as well. The developing countries are operating as much on the fear of the unknown with regard to new technologies. It is a fear that is well understood in this country by businesses, small or large.

Many of our own business are not yet clear from which direction their technological solution may come. The primary difference is the extent to which the developing nations may also have the ability to apply resources to adopt the new developing technologies. As these new technologies become available, it is expected that these fears will subside.

In meetings with the representatives of these nations, they were focused to a significant extent on obtaining the production technology for the new chemicals, such as the HFCs, and HCFCs. This focus is short-sighted. CFCs are a popular compound because of the ability to use these compounds to add substantial value to new products. In the United States, the sale of CFC chemicals is worth only $600 million a year. But results in annual goods and services from the use of these compounds is valued at more than $28 billion in the United States.

In the long run, developing countries would be benefitted more from building their user industries, rather than being preoccupied with building a chemical plant. Based on our analysis, the HFC and HCFC chemicals will only account for approximately 40 percent of the current CFC replacement market. Improved conservation and recycling methodology will replace 30 percent of the current usage, and not-in-kind substitution will replace another 30 percent.

Some of these latter technologies are available today, whereas much of the development work on the substitute compounds and their utilization are still years from completion. The Alliance has encouraged our Government and UNEP to help focus the technology transfer issue in a rational manner, and on a process that is consistent with the environmental protection goal in developed nations, ozone protection technology transfer is occurring on a phased basis.

Industry believes the same process will have to be followed for developing nations. We believe that the priorities for technology transfer on ozone depletion are one, recycling reclamation and conservation technology, two, current, not-in-kind substitution of products and processes, getting away from using CFCs, three, utilization of new HFC and HCFC compounds, and four, production technology for those new compounds.

These steps are not mutually exclusive, but they are ordered in a manner generally consistent with the time required to complete the development of the technologies for transfer.

United States industry has taken a strong leadership position in the effort to establish technology transfer programs. The Alliance worked with UNEP to organize an informal consultation on the issue in May with developing countries. We believe, however, if real technology transfer is to occur, it is essential that information be exchanged between industry representatives, not through government or diplomatic channels.

This process will require the identification of where CFC technologies are currently being utilized in Article 5 countries. It is then imperative that industry representatives from those countries meet with industry representatives from developed countries to discuss how best to implement the new environmentally protective technologies.

We have offered to assist in the creation of such a program through UNEP. Two such programs have already been alluded to earlier, one, the electronics industry program with the cooperative on ozone layer protection, and two, the air conditioning industry's effort to establish an international refrigerant data base on substitute refrigerants.

Care must also be taken to ensure that the Protocol provisions on trade sanctions be used appropriately to discourage non-parties from gaining any economic advantage in the shipment of CFC-containing equipment to parties or to non- parties. Further, care must also be taken to ensure that the Article 5 exemptions concerning allowance of continued CFC use until the year 2010 for basic domestic needs is not misused by these nations to manufacture products that they hope to export to other countries.

Finally, Article 5 countries must also be willing to honor international intellectual property rights laws and be willing to abide by standard commercial practices. This includes the recognition of patent protections and compliance with commercial licensing agreements.

The technology transfer process, unfortunately, also creates opportunities for mischief among our global competitors. Clearly, the race to establish market position in ozone protecting technologies is on among the U.S., European and Japanese industries. The Government needs to apply pressure where necessary so that the burden of technology transfer is shared along with the benefit. As an example, all developed nations should be encouraged to contribute to the informational data bases being developed under these industry programs.

Finally, I return to the issue of a stable regulatory environment. The world has now established a clear regulatory schedule for the elimination of CFC compounds based on sound, scientific, economic and technological analyses. These regulatory goals are tough, technology-forcing and environmentally effective. Policy makers in the U.S. and around the world need to let the Protocol process work. Technology transfer will occur more rapidly and effectively if we resist the temptation to change the rules in mid-stream. Frequent changes in the regulatory goals will only serve to create greater confusion and economic chaos. Stability is essential in order to facilitate the investments necessary to achieve the rapid phase-out of CFCs.

Industry in the United States has recognized the environmental necessity, understands the regulatory goals, and is prepared to seize on the economic opportunity. This means we need to resist continual adjustments in the international regulatory framework unless there is compelling new scientific information. In the United States, it means discouraging the adoption of disruptive unilateral regulatory programs at the Federal, state and local level, tax programs that siphon capital from the industries working to develop these technologies, or command and control programs at the state and local level that siphon away industry resources will only delay our ability to develop solutions to this global environmental concern.

The technology transfer discussion is largely about the confidence and the fairness and effectiveness of the international framework. Developing countries are seeking assurances that new technologies will be available to them. Industry is seeking assurances that a stable regulatory environment will allow them to develop these new technologies with an opportunity for a fair return on investment. It is possible to achieve the environmental protection goal if policy makers are mindful of the need to provide these assurances. The confidence that has developed in the successful pursuit of this process will enhance our ability to address broader global issues, such as the greenhouse effect.

Failure to provide these assurances will only slow the global ozone protection effort and seriously diminish our ability to deal with these future issues.

The Montreal Protocol continues to serve as an unprecedented example of global cooperation and goodwill. It addresses a complex scientific environmental concern, while balancing the economic concerns of developed and developing nations. It is in our best interests to maintain a balanced, supportive perspective if this framework is to remain a model for the future.

Thank you very much, and I appreciate the opportunity to speak, and look forward to answering questions.

[The prepared statement of Mr. Fay follows:]

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STATEMENT

OF

KEVIN J. FAY
EXECUTIVE DIRECTOR
ALLIANCE FOR RESPONSIBLE CFC POLICY

BEFORE THE

HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURAL RESEARCH, AND ENVIRONMENT

ON THE

MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

JULY 11, 1990

TESTIMONY OF THE
ALLIANCE FOR RESPONSBILE CFC POLICY
BEFORE THE
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
JULY 11, 1990

Good Morning. My name is Kevin Fay, and I am Executive Director of the Alliance for Responsible CFC Policy. The Alliance is a coalition of CFC user and producer industries in the United States. The Alliance has been a strong supporter of the international framework for protecting the ozone layer and has participated in all of the negotiating sessions leading to the Montreal Protocol and its most recent revisions. We appreciate this opportunity to appear before your subcommittees to discuss the strengthening of the Protocol and the importance of technology transfer in order to ensure its effectiveness.

The Montreal Protocol framework continues in an unprecedented manner to give us hope for protecting and restoring the earth's ozone layer to its conditions prior to the discovery of the Antarctic ozone hole. It is a solid regulatory achievement built on a foundation of global cooperation and goodwill among governments, industry, and environmental organizations. It attempts to address a very complex scientific objective while balancing the economic concerns of the developed and less developed nations.

In 1987, it became apparent that the Protocol was a remarkable achievement that would require enormous effort in order to achieve its full potential. Now, after the London meeting of the parties, it is apparent that the Protocol process can and will work. It is incumbent on us all, policymakers in the United States, and the industries that are being asked to produce the technological solutions, to continue to strive to make this process work.

You have raised several questions in your testimony concerning the Protocol revisions and issues pertaining to technology transfer and the participation of developing countries. We will attempt to touch on these questions in order of presentation.

Attached as Exhibit I is a summary of the key revisions to the Protocol control schedules for CFCs, methyl chloroform, halons, and HCFCs. We believe that this control schedule attempts to strike the proper balance towards achieving the rapid phaseout of the CFC compounds while taking into account the availability of safe substitutes and the needs of existing installed equipment; it also establishes a reasonable posture with respect to the substitute compounds currently under development, particularly the HCFC compounds. Both elements are critical to encouraging maximum participation by all nations developed and less-developed. Full participation in the Protocol by all nations is essential if we are to achieve the chlorine reductions necessary to protect and restore the ozone layer.

The Parties also agreed to language to facilitate the provision of technical and financial assistance for developing countries. This language was very important to give further encouragement and inducements to these nations to participate in the Protocol process. The combination of the creation of a funding mechanism to assist developing countries that are party to the Protocol (so-called Article 5 countries) to meet agreed incremental costs in order to comply with the control measures of the Protocol, and the sanctions for non-compliance, should provide sufficient incentives to insure participation by key developing countries. It is our understanding, for example, that at the end of the London meeting, representatives of China and India indicated that they would recommend to their governments that they ratify the Protocol.

In order for this process to work effectively, the U.S. and other developed countries, will need to

1) create and maintain a stable regulatory environment that will facilitate the development of the needed new technologies; and

2) ensure that the Protocol is enforced fairly throughout the world so that no nation is allowed to gain an unfair competitive advantage at the expense of other nations or at the expense of the ozone layer.

This means that the Protocol will continue to require that mix of science, technology, and diplomacy that has been its hallmark to date.

Technology transfer to developing countries was a key issue, but not very well understood. It is clear that the issue had to be resolved. As you can see in Figure 5 of Exhibit II, less developed countries (LDCs) represent a small portion(15%) of the current world CFC demand. Of that percentage, approximately 2/3 of the LDC usage is by nations not party to the Protocol. It is expected that the LDCs could represent up to 35% of demand of substitute compounds by the year 2030. If instead of switching to HCFCs, the LDC nations were to decide to continue using CFCs until 2015, atmospheric chlorine would still be close to 4 parts per billion in the year 2100. Assuming 100% participation in the Protocol, we believe that atmospheric chlorine concentrations will peak at approximately 4 parts per billion and be reduced to less than 2 parts per billion by the year 2075.

It is imperative that we encourage these LDCs to switch to non-CFC technologies as soon as possible, and not encourage them to wait until the period has ended for their special use exception.

Technology transfer came was viewed during the discussions as a broader geopolitical issue. In reality, technology transfer occurs all the time in our economy as a means of expanding product usage and marketing. The process is not all that different in this instance, save for the overriding environmental objective we are striving to achieve. In our view, technology transfer will occur naturally. During the Protocol negotiations however, it was used as a surrogate to achieve other purposes as well.

The developing countries are operating as much on the fear of the unknown with regard to new technologies. It is a fear that is well understood in this country by businesses small or large. Many of these businesses are not yet clear from which direction their technological solution may come. The primary difference is the extent to which these developing nations have the ability to apply resources to alter current CFC-reliant equipment or to adopt the new developing technologies in their facilities. As these new technologies become available, it is expected that these fears will subside.

Early discussion of the technology transfer issue was so completely caught up in the financial assistance discussion that it detracted from the resolution of the real issues. It appears that behind the technology transfer issue many developing country representatives were really thinking "industrial development". CFC-driven technologies are particularly critical to the improvement of the health and well-being of the people in these nations. Progress has been made in this area now that the financial mechanism has been narrowed in focus and duration and its size considerably reduced. We will need to be vigilant, however, as details are worked out on what is meant by "incremental costs", "fair and favorable conditions", and some of the other terms that are used in Article 10.

In meetings with representatives of these nations, and in listening to their comments during the Protocol sessions, the developing country representatives were focused to a significant extent on obtaining the production technology for the new chemicals such as the HFCs and HCFCs. This focus is shortsighted. CFCs have been popular compounds because of the ability to use these compounds to add substantial value to new products. In the United States, the sale of CFC chemicals is worth approximately $600 million per year, but annual goods and services resulting from the use of these compounds is valued at more than $28 billion. In the long run, the developing countries would benefit more from building their user industries rather than being preoccupied with building a chemical plant.

Based on our analysis, it is appears that the HFC and HCFC chemicals will only account for approximately 40% of the current CFC replacement market. Improved conservation and recycling methodology will replace 30% of the current usage, and not-in-kind substitution will replace another 30%. Some of these latter technologies are available today; whereas much of the development work on the substitute compounds, including the toxicological analysis and determination of most efficient production processes, as well as the development of means to utilize the substitutes are still years from completion.

Because of the long leadtimes necessary, the Alliance has encouraged the U.S. government and UNEP to help focus the technology transfer issue in a rational manner and in a process that is consistent with the environmental protection goal. In developed nations, ozone protecting technology transfer is occurring on a phased basis. The same process will have to be followed for developing nations. Industry believes that priorities for technology transfer on the ozone depletion issue are:

1) Recycling, reclamation and conservation technology - technologies to reduce the emission of current CFC compounds was the best opportunity in the short-term to reduce CFC usage and is where the developing countries are placing their first efforts;

2) Current not-in-kind substitution of products and processes - to replace CFC usage with currently available non-CFC technologies, such as aqueous cleaning and some foam blowing applications;

3) Utilization of new compounds - technology to use the compounds under development such as HFCs and HCFCs (which requires, in many cases, longer-term research, research on ancillary products or technologies, and large scale capital investment);

4) Production technology for new compounds - to allow for research into the most efficient production processes, identification of most appropriate compounds (based on user input), and development of efficient, safe, and environmentally acceptable production processes.

These steps are not necessarily mutually exclusive, but they are ordered in a manner generally consistent with the time required to complete the development of the technologies for transfer.

U.S. industry has taken a strong leadership position in the effort to establish effective technology transfer programs. The Alliance worked with UNEP to organize an informal consultation on the issue in May. A copy of the report from that meeting is attached as Exhibit III. Additional meetings are planned to work out further details of this effort, but it is unclear if this will have to wait until organizational details for the financial mechanisms Executive Committee are complete.

If real technology transfer is to occur, it is essential that information exchange occur between industry representatives, not government or diplomatic channels. This process will require the identification of where CFC technologies are currently being utilized in Article 5 countries. It is then imperative that industry representatives from those countries meet with industry representatives from developed countries to discuss how best to implement the new environmentally protective technologies. We have offered to assist in the creation of such a program through UNEP.

Examples of projects underway include the Industry Cooperative on Ozone Layer Protection (ICOLP) and the effort by the Air Conditioning and Refrigeration Institute (ARI). ICOLP is an industry funded organization of companies in the electronics industry that is planning to make information available on the reduction of use of CFC solvents in the manufacture of electronic components. ARI, the U.S. trade association of manufacturers of heating, ventilating, air conditioning and refrigeration products, is working to develop a refrigerant database of critical information on materials compatibility and lubricant property information that will be made available worldwide (see Exhibit IV).

Care must also be taken to insure that the Protocol provisions on trade sanctions be used appropriately to discourage non-Parties from gaining any economic advantage in the shipment of CFC reliant equipment to Parties. Further, care must also be taken to ensure that the Article 5 exemptions concerning allowance of continued CFC use until the year 2010 for "basic domestic needs" is not misused by these nations to manufacture products that they hope to export to other countries.

Article 5 countries must also be willing to honor international intellectual property rights laws, and be willing to abide by standard commercial practices. This includes the recognition of patent protections and compliance with commercial licensing agreements.

The technology transfer process also creates opportunitites for mischief among our global competitors. Clearly, the race to establish market position in ozone protecting technologies is on among U.S., European, and Japanese industries. The government needs to apply pressure where necessary so that the burden of technology transfer is shared along with the benefit. As an example, all developed nations should be encouraged to contribute to the informational databases being developed, whether it relates to electronics cleaning technology being developed by ICOLP, or materials compatibility with newly developed refrigerants being developed by ARI, or other efforts7

Finally, I return to the issue of a stable regulatory environment. The world has now established clear regulatory goals for the elimination of CFC compounds based on sound scientific, economic and technological analysis. These regulatory goals are tough, technology forcing, and environmentally effective.

The Protocol process has shown that it can work. Policymakers in the U.S. and around the world need to let the process work. Technology transfer will occur more rapidly and effectively if we resist the temptation to change the rules in mid-stream. Frequent changes in the regulatory goals only serves to create greater confusion and economic chaos.

Stability is essential in order to facilitate the investments necessary to achieve the rapid phaseout of CFCs. Industry in the United States has recognized the environmental necessity, understands the regulatory goal, and is prepared to seize on the economic opportunity. Policymakers will enhance our ability to develop the technologies to be transferred if we have a stable regulatory environment.

This means we need to resist continual adjustments in the international regulatory framework absent compelling new scientific information. In the United States, it means discouraging the adoption of disruptive unilateral regulatory programs at the Federal, state and local levels. Tax programs that siphon capital from the industries working to develop these technologies, or command and control programs at the state and local level that siphon away industry resources, will only delay our ability to develop solutions to this global environmental concern.

The technology transfer discussion is largely about the confidence in the fairness and effectiveness of the international framework. Developing countries are seeking assurances that new technologies will be available to them. Industry is seeking assurances that a stable regulatory environment will allow them to develop these new technologies with an opportunity for a fair return on investment.

It is possible to achieve the environmental protection goal if policymakers are mindful of the need to provide these assurances. The confidence that is developed from the successful pursuit of this process will enhance our ability to address broader global issues such as the greenhouse effect. Failure to provide these assurances will only slow the global ozone protection effort and seriously diminish our ability to deal with these future issues.

Exhibit 1

ALLIANCE FOR RESPONSIBLE CFC POLICY
2011 EYE STREET, N.W., SUITE 500
WASHINGTON, D.C. 20006
(202) 429-1614

FAX (202) 457-9121

KEY COMPONENTS OF LONDON CFC PROTOCOL AGREEMENT*

June 29, 1990

- **CFC PRODUCTION:** complete phaseout in accordance with the following schedule:

7/1/89	freeze at 1986 production and consumption levels
1/1/93	reduce from 1986 levels by 20%
1/1/95	reduce from 1986 levels by 50%
1/1/97	reduce from 1986 levels by 85%
1/1/2000	reduce from 1986 levels by 100%

  - Call for future assessment to determine if a complete phaseout by 1/1/97 is achievable.

- **HALON PRODUCTION:** complete phaseout in accordance with the following schedule:

1/1/92	freeze at 1986 production and consumption levels
1/1/95	reduce from 1986 levels by 50%
1/1/2000	reduce from 1986 levels by 100%*

  - Parties to develop a list of "essential" Halon uses by 1993 that may be exempted in the future from the year 2000 complete phaseout requirement.

METHYL CHLOROFORM: complete phaseout in accordance with the following schedule:

1/1/93	freeze at 1989 production and consumption levels
1/1/95	reduce from 1989 levels by 30%
1/1/2000	reduce from 1989 levels by 70%
1/1/2005	reduce from 1989 levels by 100%

- **CARBON TETRACHLORIDE:** complete phaseout in accordance with the following schedule:

1/1/93	freeze at 1989 production and consumption levels
1/1/95	reduce from 1989 levels by 50%
1/1/2000	reduce from 1989 levels by 100%

- **HYDROCHLOROFLUOROCARBONS (HCFCS):** Declaration of intent to phaseout transition compounds no later than 1/1/2040 and, if possible, no later than 7/1/2020. HCFCs were deemed essential by the UNEP assessment process if a phaseout of CFCs by the year 2000 was to be achieved.

- Establishment of **fund** to assist parties who are **developing countries** operating under Article 5 of the Protocol. For the first three years, the fund would total $160 million and could increase to $240 million if key developing nations such as China and India become parties.

**Information believed accurate at time of writing, but should be verified against official documents when released.*

ALLIANCE FOR RESPONSIBLE CFC POLICY
2011 EYE STREET, N.W., SUITE 50C
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Embargoed For Release
Until 5:00 P.M. (U.S. EDST)
June 29, 1990

Contact: Kevin Fay
(202) 429-1614

CFC INDUSTRY HAILS AGREEMENT STRENTHENING PROTOCOL, URGES CONGRESS TO CONFORM U.S. LAW

June 29, 1990, Washington, D.C. -- The Alliance For Responsible CFC Policy commended the agreement reached today at the conclusion of the Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer.

"Today's agreement to strengthen the Montreal Protocol caps the growth in ozone damaging atmospheric-chlorine from man-made CFCs, provides significant regulatory and economic incentives for the introduction of ozone friendly substitute technologies, and creates substantial incentives and sanctions to encourage worldwide participation by developed and developing countries." said Kevin Fay, CFC Alliance Executive Director. "The changes agreed to today chart a proper and sensible course for the world community to act in concert to eventually eliminate the hole in the Antarctic ozone layer," he said.

In agreeing to support a phaseout of chlorofluorcarbons (CFCs) and other ozone depleting compounds by the year 2000, the Parties have cleared the way for industry to fulfill its role of developing and implementing ozone protecting technologies. "This schedule will also protect consumers and small businesses who own equipment that relies upon CFCs," said Fay. "The transition period will go a long way toward preventing the premature loss of more than $135 billion worth of equipment critical to everyday activities."

In a continuation of the historic and unprecedented Montreal Protocol accords, the Party nations put aside parochial interests to adopt changes consistent with the lengthy review of scientific, economic, technological and environmental effects information, that was conducted over the last two years. The review process included hundreds of experts from governments, industry, and environmental organizations.

Importantly, the parties also agreed to the establishment of a fund to assist developing nations that are party to the agreement. This fund, which will total between $160 and $240 million for the next three years, will assist these developing countries in identifying their use of ozone depleting compounds and in implementing ozone protecting technologies. Details of the administration of the fund remain to be developed.

The Alliance For Responsible CFC Policy will review the revised treaty documents in anticipation of supporting its ratification by the United States Senate. The Alliance urges the U.S. Congress, particularly the conferees for the Clean Air Act amendment legislation, to take note of the substantial strengthening of this important international agreement. "It is important for the Congress to be supportive of the Protocol framework and to adopt CFC provisions to the Clean Air Act that are consistent with the Protocol." Fay said. The Congress is expected to begin in July to reconcile the different versions of Clean Air Act amendments, S. 1630 and H.R. 3030, both of which contain a title on the control of chlorofluorocarbons and other ozone depleting compounds.

The CFC Alliance is a coalition of U.S. companies that use or produce CFC compounds. The Alliance has been an active participant in the Montreal Protocol process and in urging a responsible global resolution to the concern for depletion of the earth's stratospheric ozone layer and the phaseout of CFCs.

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U.S. CFC/HCFC PHASEOUT LEGISLATION COMPARED TO 6/90 MONTREAL PROTOCOL REVISIONS

	S. 1630 Title VII	H.R. 3030	Montreal Protocol Revisions 6/90
1) Controlled Substances (Class I)	CFC-11, 12, 113, 114, 115, Halon-1211, 1301,2402 carbon tetrachloride	CFC-11, 12, 113,114, 115 Halon-1211, 1301,2402 carbon tetrachloride methyl chloroform	Same as S.1630
2) Other regulated substances (Class II)	HCFC-22,123, 124, 141(b) methyl chloroform	HCFC-22,123, 124, 141(b) 142(b)	Same as S.1630
3) Ozone Depletion Factor:			
CFC-11	1.0	1.0	1.0
CFC-12	1.0	1.0	1.0
CFC-113	0.8	0.8	0.8
CFC-114	1.0	1.0	1.0
CFC-115	0.6	0.6	0.6
HCFC-22	0.05	0.05	not yet listed
HCFC-123	0.02	0.02	not yet listed
HCFC-124	0.02	0.02	not yet listed
HCFC-141(b)	0.1	0.1	not yet listed
HCFC-142(b)	0.06	0.06	not yet listed
Halon-1211	3.0	3.0	3.0
Halon-1301	10.0	10.0	10.0
Halon-2402	6.0	6.0	6.0
carbon tetrochloride	1.06	1.06	1.1
methyl chloroform	0.15	0.15	0.1
	adjustable by EPA	adjustable by EPA	
4) Reporting Requirements			
Class I	annual production and imports	annual production	annual production and imports
Class II	annual production and imports	annual production	annual production and imports

	S. 1630 Title VII	H.R.3030	Montreal Protocol Revisions 6/90
5) Production Phaseout Class I	7/1/89-1986 levels	180 days after enactment	7/1/89 - 1986 levels
	7/1/93-80% 1986 levels 7/1/98-50% 1986 levels 7/1/2000- total phaseout	7/1/91 - 100% of 1986 levels 7/1/92 - 90% of 1986 levels 7/1/93 - 80% of 1986 levels 7/1/94 - 65% of 1986 levels 7/1/95 - 50% of 1986 levels 7/1/96 - 40% of 1986 levels 7/1/97 - 30% of 1986 levels 7/1/98 - 20% of 1986 levels 7/1/99 - 10% of 1986 levels 7/1/2000 - total phaseout	1/1/93 - 80% of 1986 levels 1/1/95 - 50% of 1986 levels 1/1/97-15 % of 1986 levels (future assessment to determine if total phaseout can be achieved by 1997)
	*controls compounds in a bubble on ozone depletion weighted basis	*controls each compound individually	same as S. 1630
Class II	1/1/2015- freeze at 2014 levels 1/1/2030-total phaseout	HCFC 22, 141b, 142b: 1/1/2015 - freeze at 2014 levels 1/1/2030 - total phaseout HCFC 123, 124: 1/1/2020 - freeze at 2019 levels 1/1/2035 - total phaseout	Reporting only on HCFCs declaration of intent to phaseout between 2020-2040
methyl chloroform	1/1/96-50% 1989 levels 1/1/2000-zero	7/1/93 - 80% of 1989 levels 7/1/94 - 70% of 1989 levels 7/1/95 - 60% of 1989 levels 7/1/96 - 50% of 1989 levels 7/1/2005 - total phaseout	1/1/93 - freeze at 1989 levels 1/1/95 - 70% of 1989 levels 1/1/2000 - 30% of 1989 levels 1/1/2005 - total phaseout

	S. 1630 Title VII	H.R. 3030	Montreal Protocol Revisions 6/90
6) Exceptions	medical purposes aviation safety export to developing countries -limit at 10% of 1986 levels	medical purposes aviation safety -limit at 10% of 1986 levels	Protocol assessment process must occur at least every four years. If assessment concludes substitutes not available,
	national security	fire suppression -no production after 1/1/99	phaseout dates may be extended
		export to developing countries	export to developing countries 10% - 1986 levels 15% - 1986 levels
7) Exchanges of Production Rights	allowed - between companies	allowed only if it results in a greater reduction than would otherwise be allowed to occur by the parties individually	allowed - between parties
8) Accelerated Schedule	EPA can accelerate schedule based on new scientific data , availability of substitutes, or revisions to Montreal Protocol	EPA can accelerate phaseout based on new scientific data, availability of substitutes, or revisions to Montreal Protocol	Accelerated controls must be negotiated through Protocol framework
9) Use Regulations	require lowest achievable emission reduction and use of substitutes by 7/1/91 small containers sold only to certified trained mechanics after 1/1/92	requires the reduction of use and emission to the lowest achievable level within 1 year; small containers banned within 2 years except to certified trained mechanics	no specific use regulations

	S. 1630 Title VII	H.R. 3030	Montreal Protocol Revisions 5/90
10) Recycling	venting prohibited 1/1/92 recycling regulations 7/1/92 disposal regulations 1/1/92 service aperture required 1/1/94	venting prohibited within 2 years after enactment recycling regulations within 3 years after enactment disposal regulations within 3 years after enactment service aperture required within 3 years after enactment	no specific recycling rules
11) Auto Air Conditioning	25% autos switched to alternatives by 1994 model year; 50% by 1996	no similar requirement	
	service with approved recycling equipment by 1/1/92	service with approved equipment 2 years after enactment; 3 years after enactment for entities performing service on fewer than 100 motor vehicle air-conditioners during 1990	no similar requirement
12) Non-essential Products	banned within 1 year of enactment bans aerosols with HCFCS and plastic foam products (other than insulation) made with HCFCs by 1/1/94	banned within 2 years after enactment bans aerosols with HCFCS and plastic foam products (other than insulation) made with HCFCs by 1/1/94	no similar provision
13) Trade Provisions	imports of substances or products from non-Montreal Protocol countries banned after 1 year; imports from countries without controls equivalent to US banned after 7/1/2000	no similar provision	imports of substances from non-parties banned; list of products containing CFCs to be developed and imports banned by 1/1/93; feasibility of listing products made with CFCs to be determined by 1/1/94 and if possible list developed and banned

	S. 1630 Title VII	H.R. 3030	Montreal Protocol Revisions 6/90
14) Investment and Technology	bans export of technology or investment to make Class I substances	no similar provision	discourages export of controlled compounds production or use technology
	allows investment if no substitutes exist but not if emissions increase		
15) Labeling	requires labeling of Class I products by 1/1/92 if substitutes are available	requires labeling of Class I products effective 1 year after enactment	no similar provision
	labeling of Class II substances authorized but not required	requires labeling of Class II products if there is a substitute for the use of such substance	
16) Safe Alternatives	EPA to review all possible alternatives	EPA to report interim findings regarding alternatives to Class I substances in 1 year. Final report in 2 years and updated every 2 years.	substitute technologies to be considered in assessment process
	EPA to recommend Federal purchase, research and encouragement of alternatives	EPA to require producers of substitutes to provide unpublished health and safety studies	
	GAO to develop in 1 year plan for government procurement of alternatives	Class II substitutes to be included in biennial report beginning in 2 years	
	health and safety data required on alternatives	EPA can require substitution by rule	
		unsafe substitutes banned in 2 years	

	S. 1630 Title VII	H.R. 3030	Montreal Protocol Revisions 5/90
17) Enforcement	$25,000/day of non-compliance allows citizen suits & judicial review	same as for CAA Section 112	trade sanctions against non-parties and non-complying parties
18) Federal Preemption	none	for a 2 year period beginning with enactment, no state or local government may enforce any requirement concerning the design of any new or recalled household and commercial appliance	no similar provision
19) Research Grants	grants for industry/government research cooperative efforts authorized	no similar provision	no similar provision
20) Aid for International Cooperation	technological and financial assistance to developing countries allowed but controlled assistance allowed but authorization deleted	technological and financial assistance of no more than $30 million to developing countries that are Montreal Protocol Parties	Fund to assist developing countries with technology transfer $160 million over 3 years ($240 million if China and India sign Protocol) to be used for studies and "incremental costs" associated with implementation of emission reduction technology and new substitute technologies

Exhibit 11

Alliance for Responsible CFC Policy

2011 "I" Street N.W., Washington, DC 20006

June 1990

REALISTIC POLICIES ON HCFCs NEEDED IN ORDER TO MEET GLOBAL OZONE PROTECTION GOALS

In March 1988, an international scientific panel issued the first consensus report implicating fully halogenated chlorofluorocarbons (CFCs) in the depletion of stratospheric ozone. The Alliance For Responsible CFC Policy, a coalition of U.S. industries that use or produce CFCs and HCFCs, announced its support for the revision of the Montreal Protocol on Substances that Deplete the Ozone Layer to achieve the phaseout of CFCs as soon as possible, consistent with the availability of safe acceptable substitutes and assuring the needs of existing installed equipment (valued in the U.S. alone to be worth more than $135 billion).

Because CFCs have many important uses—ranging from food preservation and air conditioning to energy-efficient insulation and medical devices—the Alliance has also stressed the need for an orderly transition to replacement products of less or no ozone depletion potential.

There are several options that jointly can achieve a timely phaseout of CFCs. First, recovery and reclamation will lower the demand for CFCs long term. Second, some CFCs will be replaced by "not-in-kind" materials, such as water-based systems or hydrocarbons for certain cleaning agent applications. Third, replacement chemicals in the fluorocarbon family will be uniquely qualified for such key uses as refrigeration, air conditioning, energy saving foam insulation and specialty cleaning for medical or critical electronics. These compounds—the hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs)—perform in a similar manner to CFCs and offer dramatically improved environmental characteristics.

HCFCs and HFCs are the best alternatives available to society during the next several decades for certain uses. The HCFCs have, on average, 95 percent less ozone depletion potential than today's CFCs, and the HFCs have no impact on ozone. Both classes of compounds make minor contribution to calculated global warming, but much less than that of the CFCs.

We acknowledge that industry's ultimate goal is to develop CFC replacements and technologies that are energy-efficient, safe in use and have no environmental impact. At this time, however, no such compound or technology has been developed for certain key applications, nor does any appear likely in the near future.

Until such products or technologies are developed, the HCFCs can facilitate a timely CFC phaseout by serving as bridging chemicals. Because the HCFCs contain small but measurable chlorine, the Alliance believes that responsible international policy will include realistic provisions for controlling these compounds so that pre-Antarctic "hole" atmospheric chlorine levels can be achieved. This approach is consistent with the goals of the science panel to the United Nations Environment Programme.

Prudent policy would support the introduction of these alternatives and their use in new equipment until at least 2030. Recycle

Global compliance to a CFC phaseout is required in order to minimize atmospheric chlorine concentrations and maximize ozone protection. A 100 percent global compliance would ensure maximum ozone protection, but uncertainty of hydrochlorofluorocarbon (HCFC) availability via production caps, ozone depletion potential (ODP) limits or regulations requiring a phaseout of HCFCs before the time period 2030 to 2050 will encourage noncompliance.

Chlorofluorocarbons (CFCs) serve many needs considered valuable to society. Those in developing countries desire to improve their standards of living through the use of goods currently dependent on CFCs. Technology assessments show that HCFCs are the only safe, viable alternatives for about 30 percent of CFC demand.

Continued use of CFCs by countries accounting for a small percentage of current CFC consumption would lead to an increase in chlorine concentrations in the stratosphere and a risk of unnecessary ozone depletion for decades. Developing countries currently account for about 15 percent of CFC consumption and, of those, countries accounting for about 10 percent of current consumption have not signed the Montreal Protocol.

Conversely, scientific analysis indicates that a transition from CFCs to HCFCs would reduce chlorine concentrations in the stratosphere, thus increasing ozone protection. An HCFC phaseout over the period 2030 to 2050 would "repair" the Antarctic ozone "hole" at the earliest possible date.

Continued use of HCFCs beyond 2030 to 2050, however, could lead to an increase in chlorine and prevent "repair" of the Antarctic ozone "hole." Recognition that HCFCs are transitional solutions and establishment of prudent HCFC phaseout dates is therefore encouraged.

and some new production provides HCFCs for servicing the declining balance of capital equipment for its 1–15 year residual life. (Some capital equipment, such as large air conditioning and refrigeration systems, last more than 30 years.)

This approach would facilitate a timely phaseout of CFCs. It would provide the certainty needed by industry and consumers to support the introduction and use of HCFCs for those CFC applications for which no environmentally benign near-term replacements are feasible. Most important, it would allow the use of HCFCs over a sufficient period to encourage developing countries to phase out of CFC production and transition to the alternative products. Without such an approach, some developing countries would likely continue to produce and/or use CFCs, leading to increased potential for environmental harm.

To date, U.S. companies have invested several hundred million dollars in research and capital for development of HCFC, HFC, and other ozone protecting technologies. The total for U.S. producers could reach $2 to $3 billion over the next decade. Much larger investments will be necessary by the industries which currently use CFCs to produce industrial and consumer durable goods.

Premature unilateral national regulations by a major nation in alternatives development could create continued uncertainty about the status of the HCFCs, thus deterring marketplace acceptance and adoption.

The Alliance For Responsible CFC Policy strongly supports global action through the Montreal Protocol that would include provisions for a complete CFC phaseout in developed countries by the year 2000 (2010 in developing countries) and controls on HCFCs that would allow their use as transitional compounds at least until the period between 2030–2050.

INTRODUCTION

United States industry strongly advocates strengthening the Montreal Protocol to completely eliminate the production of fully halogenated chlorofluorocarbons (CFCs). However, the phaseout must occur in concert with an orderly transition to alternative products, particularly the hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs) to minimize disruptions to society.

HCFCs and HFCs, which are necessary to achieve a safe, orderly global phaseout of CFCs, should not be regulated over the period of a normal product life cycle (30–40 years for these chemicals and capital equipment that uses them). Regulation of these compounds will increase uncertainty among producers and users and could delay or stop necessary investment. Near-term production and use regulations will likely lead to prolonged use of CFCs, resulting in increased chlorine concentrations in the atmosphere and increased probability of damage to the ozone layer.

As little as 1% noncompliance to a CFC phaseout in high growth LDC (less developed countries') economies contributes more total chlorine emissions than would occur from ten years of HCFC use by the entire world. For this reason we believe HCFCs must be in the world's alternative plans for sufficient time to assure that LDCs do not postpone CFC phaseout while waiting for solutions that have no environmental impact but may be available only in the distant future.

Since HCFCs contain chlorine and can contribute low, but measurable, amounts of chlorine to the ozone layer, some policymakers and environmentalists have been reluctant to support the introduction of HCFC alternatives without restrictions. They fear that unlimited, continued growth in the emissions of these compounds could eventually lead to increases in atmospheric chlorine.

Thus an approach is required that will encourage a series of investments over the next two decades for the transition from CFCs to HCFCs and at the same time prevent unlimited growth in the use of HCFCs. Time certain dates for the phaseout of HCFCs that allow a normal product life cycle beyond the transition period satisfy this requirement. It would provide the regulatory certainty needed to encourage development of HCFCs and would also ensure that the search for "non-chlorine" options continues.

Time certain phaseout dates in the time period 2030–2050 for HCFCs could provide the regulatory certainty to minimize atmospheric chlorine throughout the next century. Specific phaseout dates within this time period can allow for differing atmospheric lifetimes for HCFCs and appropriate time lags for developing countries.

CFC PHASEOUT REQUIRED

The discovery of the Antarctic ozone "hole" in 1985 and the role that chlorine plays in the development of this localized, seasonal ozone depletion, has undermined confidence in the calculations of ozone changes that might result from continued use of CFCs.

A conservative approach to projecting potential effects involves examining future chlorine concentrations in the atmosphere under various assumptions of emissions of chlorine-containing compounds. An approach that minimizes chlorine concentrations and still meets societal needs provides the optimum solution.

Using this approach, the items of most concern from an ozone protection standpoint are the long-lived, fully halogenated compounds—CFCs and carbon tetrachloride. Current scientific information indicates that most, if not all, of the chlorine content of these compounds is transported to the stratosphere where it has the potential to destroy ozone. Furthermore, these compounds remain in the atmosphere for about 100 years, providing a significant background chlorine concentration.

An 85 percent reduction in global CFC emissions from 1986 levels is necessary just to maintain current atmospheric levels of chlorine from these compounds. If the goal is to reduce, rather than stabilize, chlorine concentrations in the atmosphere, the overall reduction in global CFC emissions must be much greater that 85 percent.

U.S. industry believes CFC emissions should be reduced by more than 95 percent worldwide to ensure protection of the ozone layer. The United States has announced its policy to support a phaseout of CFCs and Halons by the year 2000 provided that safe substitutes are available.

Industry Estimate of How CFC Demand Could Be Satisfied in Year 2000

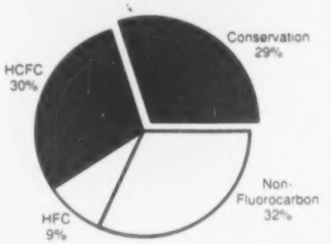

Figure 1. About 60% of future demand can be met through increased conservation measures (practices which actually decrease overall demand for new production) and use of non-fluorocarbon alternatives. The only viable options for meeting the remaining 40 percent of demand for essential societal needs in the year 2000 are HCFCs and HFCs.

SATISFYING CFC DEMAND IN THE YEAR 2000

The research of U.S. industries and others has identified HCFCs and HFCs as the leading candidates to meet societal needs and protect the environment.

The Technology Review Assessment Panel Report sponsored by UNEP and presented in August, 1989, at Nairobi, Kenya, concluded that HCFCs and HFCs now being developed must be commercially available if the phaseout of CFCs in developed countries is to be accomplished by the year 2000.

Industry analysis has been performed on the potential for satisfying demand for goods and services provided by CFCs, assuming full compliance to a CFC phaseout by the year 2000 in developed countries.

Figure 1 shows the results based on a global market model and current information on alternatives to CFCs. About 30 percent of the demand could be met through improved conservation practices, including better maintenance of refrigeration and air conditioning systems, recovery and recycle during servicing of equipment and recovery and recycle of material used for cleaning applications. These practices are currently being implemented for CFCs and it is likely that they would be continued for the new compounds. Conservation actually decreases overall demand; hence, that part of the pie is shown removed.

Non-fluorocarbon alternatives could meet another 30 percent of the demand. Most of the aerosol propellant uses (about 20 percent of global CFC use in 1988) will probably be converted to non-fluorocarbon alternatives as they were in the U.S. during the late 1970s. Several cleaning agent and blowing agent applications also will be converted to alternatives outside the fluorocarbon family.

Based on current data, the only viable options for meeting the remaining demands for essential societal needs are HCFCs and HFCs.

About 10 percent of these demands, primarily in refrigeration applications, could be met through the use of HFCs. Because HFCs do not contain chlorine, their vapor pressures are generally higher and their solubility properties generally lower than CFCs. These two characteristics limit their use for many applications. HCFCs could meet the remaining 30 percent of demand, primarily in the areas of refrigeration and air conditioning, energy-efficient insulating foams and cleaning of critical electronic and medical components.

HCFCs WILL REDUCE ATMOSPHERIC CHLORINE LEVELS

HFCs do not contain chlorine, the compound believed to contribute to the formation of the Antarctic ozone hole. In HCFCs, the addition of hydrogen (H) to the CFC structure allows the removal of virtually all chlorine in the lower atmosphere before it can reach the ozone layer. Because the chlorine is dissipated at lower altitudes, the HCFCs have relatively short atmospheric lifetimes—from 2 to 20 years—and only a small fraction (2 to 15 percent) of their chlorine is transported to the ozone layer.

The timing of CFC emission reductions is important because CFCs have long atmospheric lifetimes (60 to 400 years) and because continued emissions would increase the background concentration of these long-lived chlorine-containing compounds. The introduction of HCFC and HFC substitutes is a critical factor in the timing of CFC phaseout and the resultant peak atmospheric chlorine levels.

Figure 2 (next page) shows results of a sensitivity analysis provided to UNEP by Drs. R. T. Watson and M. J. Prather of the U.S. National Aeronautics and Space Administration. They assume a phaseout of all man-made chlorine compounds with lifetimes longer than one year in the year 2000 and a wide range of HCFC substitution scenarios starting in 2000. Use of HCFCs is assumed to stop suddenly in 2030.

The sensitivity analysis shows three important factors that must be considered in formulating policy to assure protection of the ozone layer:

- The peak chlorine concentrations are controlled primarily by the rate of transition away from CFCs.
- Replacing CFCs with HCFCs leads to reductions in chlorine concentrations.
- Use of HCFCs does not affect the time required to return to chlorine concentrations that existed before the Antarctic ozone "hole" if HCFC use is stopped during the 2030–2050 timeframe. The time required to return to these chlorine concentrations is determined primarily by the rate of transition away from CFCs.

Because of the threat of near-term regulation of HCFCs, less than 10 percent of the needed capacity to transition away from CFCs is available or announced as under construction: hence, CFC phaseout is threatened. Thus, policy should be formulated to encourage the rapid development of HCFCs and the goods and services that use them in order to minimize the peak chlorine concentration and the time required to return to chlorine levels that existed before the Antarctic ozone "hole". However, growth in the use of HCFCs beyond the period 2030–2050 could lead to increases in chlorine concentrations.

GLOBAL COMPLIANCE REQUIRES HCFCs AND HFCs

Policies that discourage the rapid development and use of HCFCs will slow the transition away from CFCs and discourage global compliance to a CFC phaseout. Developed countries would need to use CFCs for a longer period to continue to meet current needs. Countries striving to develop their economies and to improve their standard of living through the use of goods and services currently using CFCs (refrigeration is an example) will be reluctant to participate in a CFC phaseout if viable alternatives are not available. Prolonged use of CFCs would result in increased chlorine concentrations. However, if viable, cost-effective HCFC and HFC alternatives are widely available, CFC use will be minimized.

Environmental Goals Can Be Met Through Use of HCFCs

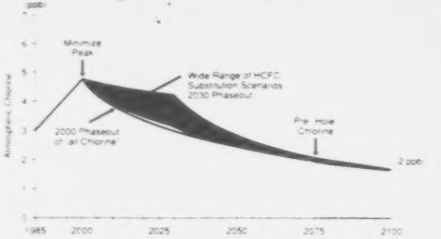

Figure 2. *Analysis presented by Drs. Watson and Prather at the Nairobi, Kenya UNEP meeting (September 1989). It assumes a total phaseout of CFCs, HCFC-22, carbon tetrachloride and methylchloroform in the year 2000. The baseline decline of CFCs is shown along with two "bracketing" HCFC substitution scenarios. The upper band assumes use and emissions of 1.8 billion kgs/yr of a compound that has a 15 year lifetime and contains one chlorine atom. The lower band assumes 450 million kgs/yr of a compound that has a 6 year lifetime and contains one chlorine atom. Current CFC use is about 1 billion kgs/yr. The analysis assumes 100% world compliance and HCFC phaseout in 2030. Pre-Antarctic "hole" levels (2 ppb) are reached in approximately 2075 in all cases.*

Figure 3 also shows the results of an analysis of chlorine levels with the most likely substitution levels of HCFCs and HFCs (from Figure 1) for CFCs plus continued use of HCFCs in current applications. The analysis assumes phaseout of CFCs in the developed countries by 2000 and phaseout of HCFCs between 2030 and 2050. Recycle and some new production provides HCFCs for servicing the declining balance of capital equipment for its 1–15 year residual life. Even with higher growth rates in developing countries, atmospheric chlorine levels continuously decrease to pre-Antarctic "hole" levels. Such a scenario requires 100 percent world compliance and has a high probability of success if there are HCFC alternatives available. Consistent with the analysis of Drs. Watson and Prather, this analysis shows that

Use of HCFCs Over Normal Product Life Cycle Will Minimize Chlorine

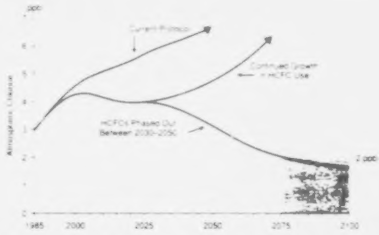

Figure 3. *Acceptance of cost-effective alternatives including HCFCs and HFCs will encourage global acceptance of a CFC phaseout and minimize atmospheric chlorine. A curve for chlorine levels that assumes 100% world compliance to the present Montreal Protocol (50% CFC phasedown by mid-1998 is shown). No growth in methylchloroform emissions is assumed. A curve for phaseout consistent with the Prather/Watson analysis in Figure 1 is also shown. The curve contains industry estimates of HCFC substitution rates and assumes that HCFCs are phased out between 2030–2050. In addition, current uses of HCFC-22 are included in the analysis. A ten year delay in CFC and HCFC phaseout dates is assumed for developing countries.*

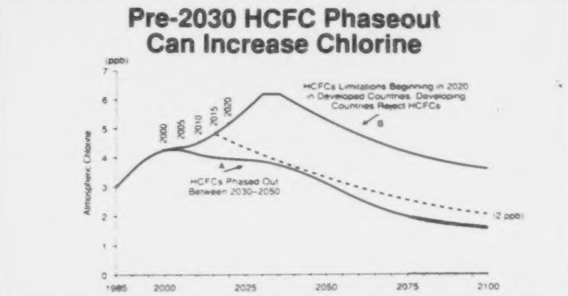

Figure 4. *Early or pre-2030 phaseout of HCFCs by developed nations may encourage noncompliance to a CFC phaseout by developing nations. Such action would contribute increasing amounts of long-lived chlorine that would not be purged from the atmosphere for another century. The effect of delay in a CFC phaseout by LDCs can be estimated by drawing a line parallel to the declining section of curve B from the point on the increasing section of curve B at the assumed phaseout date. Even if LDCs only delayed their phaseout until 2015 the increase in long-lived chlorine would assure persistance of the Antarctic "hole" well into the 22nd century.*

transition from CFCs to HCFCs with time certain HCFC phaseout dates minimizes atmospheric chlorine.

Acceptance of cost-effective alternatives including HCFCs and HFCs will encourage global acceptance of a CFC phaseout and minimize atmospheric chlorine.

Figure 4 shows an analysis of one probable effect if HCFCs are not available over a normal product life cycle. As shown in Figure 5, regulations requiring an early HCFC phaseout would create a global shortage of HCFCs, encouraging continued use of CFCs by some developing countries. The continued use of CFCs to meet growing demands in developing countries can dramatically increase atmospheric chlorine concentrations, even if a total phaseout of all chlorine-containing compounds was accomplished in developed countries by the year 2000. This noncompliance scenario is compared to chlorine levels with 100% compliance to the present Montreal Protocol.

The demand for CFCs in developing countries is projected to grow at three to four times the rate in developed countries (2.5 percent compounded growth in developed countries is assumed). Those larger growth rates are used in this analysis. Ultimately, the compliance of developing countries to a CFC phaseout will be the critical factor in limiting atmospheric chlorine. Stringent regulations on alternatives could increase the probabilities of noncompliance and thus could actually result in increases to atmospheric chlorine. The availability of HCFC alternatives will reduce the risk of this unintended result.

RAPID INTRODUCTION OF HCFC AND HFC SUBSTITUTES

To achieve a smooth transition within the next ten years, industry must begin now to make major capital investments. The total for producers could reach $4 to $6 billion over the next decade. Much larger investments will be necessary by the industries which currently use CFCs to produce industrial and consumer durable goods.

The CFC producing and using industries need prompt and clear encouragement from policymakers to develop the HCFCs and HFCs that can accomplish a timely transition away from CFCs.

With the support of national and international policymakers and continued promising results from toxicity tests, investments by industry can be made so the transition to HCFC and HFC alternatives can be virtually completed by the year 2000 in developed nations and by 2010 in developing nations. However, if policymakers view HCFCs and HFCs as short-term solutions providing only marginal benefits, industry would have difficulty justifying the significant additional resources that will be needed to develop and commercialize these compounds. To achieve a timely, orderly transition, the following are essential:

- Commitment of capital for facilities to produce commercial quantities of the HCFC and HFC alternatives. Construction of new facilities can take 3–5 years.
- Commitment of resources by manufacturers of goods, such as refrigeration equipment, insulating foams and cleaning processes, to develop the necessary technology to use HCFCs and HFCs.
- Commitment of capital for facilities to commercially produce goods using HCFCs and HFCs.

Uncertainty regarding the acceptability of HCFCs and HFCs will slow each step. Decisions by policymakers will determine the transition time. If these alternative compounds are not regarded as solutions over the period of a normal product life cycle (30–40 years) with provisions for continued service of long-lived equipment, we believe their development will be slowed or stopped.

Regulation, or the threat of regulation, also sends a strong message to developing countries that HCFCs and/or HFCs are not considered acceptable solutions. To avoid a second transition before full value of HCFCs was attained, the developing countries could decide not to consider adopting HCFC alternatives at the outset but continue to use CFCs until the ultimate nonchlorine solutions are made available to them.

TIME CERTAIN PHASEOUT DATE FOR HCFCs

Some policymakers and environmentalists are reluctant to fully support the introduction of HCFCs since they result in emissions of chlorine to the atmosphere. Unrestricted worldwide growth could eventually lead to the growth of atmospheric chlorine levels and can delay the time for atmospheric chlorine levels to decrease to a goal value.

However, establishment of time certain phaseout dates for HCFCs could help resolve such uncertainties that surround their introduction. Such dates, if supported worldwide and included in the Protocol, would offer the following advantages:

- Removes uncertainties for industries that are poised for large investments in both HCFC production and equipment that uses HCFCs, provided that normal product lifecycles are built in to the phaseout dates that allow reasonable returns at reasonable prices on those investments.
- Provides assurances that chlorine emissions from HCFCs will be limited.
- Provides incentive for continued development efforts of "ideal" non-chlorine alternatives and allows for normal product evolution from research to development to commercialization.
- Provides certainty for all nations in HCFC product lifetimes and thus provides incentive for world Protocol compliance.
- Provides impetus for most rapid worldwide phaseout schedule for CFCs.
- Minimizes peak atmospheric chlorine levels, minimizes the time at elevated chlorine levels and minimizes the time for disappearance of the Antarctic ozone "hole".

Time certain phaseout dates for HCFCs must be given careful consideration. The following criteria must be considered:

- The best available scientific information should form the basis for any phaseout policy.
- The phaseout dates must recognize that a series of investments must be made over the next 1–2 decades to assure sufficient chemical and end-product supply investments are made to not only phaseout today's CFC but to meet the growing demand, primarily in LDCs, for goods and services using these materials. Phaseout dates must provide normal product lifetimes for all these investments.
- The phaseout date must be sufficiently distant from the required phaseout date for CFCs, particularly in developing countries, so that these countries will not simply continue to use CFCs until the "perfect" solution is offered. It is likely that the developing world will not be switching completely to HCFCs until 2010 primarily because product availability and technical resources will be committed to achieving the 2000 mandated phaseout in the developed world.
- Countries that are considered less developed (LDCs) at that time can be given special allowances in accomplishing the HCFC phaseout, similar to the special provisions allowed for use of CFCs in LDCs in the present Protocol.

Phaseout dates between 2030 and 2050 for HCFCs would meet each of these criteria. In addition, these phaseout dates would allow atmospheric chlorine levels to decrease to pre-Antarctic "hole" levels (2 ppb) at the same time now projected in the Watson and Prather analysis due to the baseline decay of CFCs coupled with the rapid elimination of chlorine from HCFCs.

Thus HCFC phaseout dates will minimize the short-term atmospheric chlorine peak, decrease and minimize the atmospheric chlorine in the next several decades by providing incentives for a rapid transition and world compliance, and produce no long-term HCFC contributions to chlorine levels.

SUMMARY

HCFCs and HFCs provide the balance in meeting essential societal needs while protecting the environment. If a transition away from CFCs is to be completed by the year 2000 in the developed nations and by 2010 in developing countries, major investment decisions by both the producers and users of alternatives must be made now and over the next 20 years.

Uncertainty about availability of HCFC and HFC alternatives delays commitments by producers of goods currently dependent on CFCs. Companies must know what alternatives will be available before committing major investment to the research and development necessary to use the new compounds in their goods.

Regulation or potential regulation of the HCFC and HFC alternatives that attempts to cap growth, volume or ozone depletion potential will delay or prohibit investments and the transition away from CFCs. Policymakers need to provide clear and prompt signals to industry and the consumer. HCFC and HFCs were determined by UNEP to be an essential component to achieve a safe, rapid transition away from CFCs. Premature regulation of these compounds may force industry to focus its resources elsewhere, delaying the introduction of compounds and technologies that will preserve the ozone layer. Such a delay will probably mean continued use of CFCs especially in those nations that have limited resources to invest in frequently changing technologies.

Inclusion of appropriate time certain HCFC phaseout dates into the Protocol should be considered as an environmentally acceptable method of providing the necessary certainty to industry that will spur the introduction of HCFC alternatives and minimize long-term chlorine levels.

Pre-2030 HCFC Phaseout Would Encourage Continued Use of CFCs

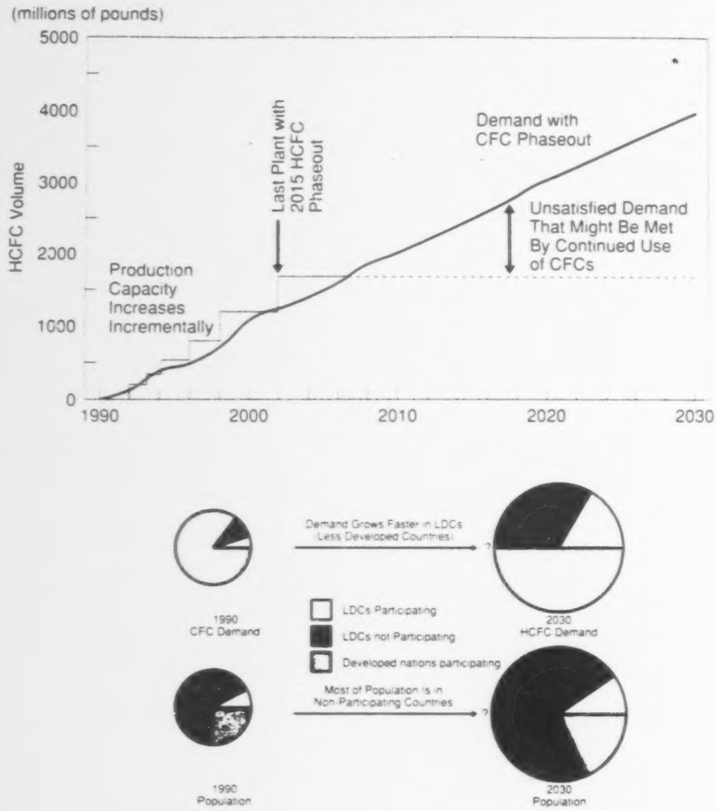

Figure 5. *Regulations requiring an early HCFC phaseout would encourage continued use of CFCs. The pie charts show the distribution of CFC demand and population among less developed countries (LDCs) participating and not participating in the Montreal Protocol and developed countries participating. Currently, countries representing about 90% of CFC demand but only about 35% of population have signed the protocol. With rapidly growing demand and population, those LDCs that have not yet signed the protocol could represent 35% of demand for HCFCs and 70% of the world's population by 2030. If LDCs believe HCFCs will not be available or that a non-chlorine solution will be fully commercial in advance of 2015, they may opt to continue to use CFCs. The graph shows that a 2015 HCFC phaseout would create an HCFC shortage and encourage CFC use. The bold line shows projected global demand for HCFCs with a CFC phaseout. The stairstep shows that capacity to produce HCFCs would be increased about every five years to meet current projected market demand. If regulations require a 2015 HCFC phaseout, producers are unlikely to commit capital for new plants after about 2000, since about 15 years would be required to recover the investment. This would lead to a shortage of HCFC supply by as early as 2010.*

Alliance for Responsible CFC Policy

THE ALLIANCE FOR RESPONSIBLE CFC POLICY IS A U.S. COALITION OF COMPANIES AND TRADE ASSOCIATIONS REPRESENTING COMPANIES THAT USE OR PRODUCE CFCs. THE ALLIANCE IS A KEY SUPPORTER OF THE "MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER."

A.L.A. Waterproofing & Insulation Inc
A.C. Supply Inc
ACR Supply Company Inc
AERO Air Conditioning & Refrigeration
AFC Roofing & Insulation Inc
AIRECO Refrigeration Inc
AIRECO Inc
APCO Inc
ARCO Chemical
ARCO Supply Inc
AT&T
Abbott Laboratories
Acco Refrigeration Supply Corp
Accoustical Spray Insulators Inc
Action-Miami
Acro-Kleen Company Inc
Admiral Company
Aeroquip Corporation
Aetna Supply Company Inc
Aim Insulation Company Inc
Air Cold Supply Inc
Air Comfort Corporation
Air Conditioning & Refrigeration Institute
Air Conditioning & Refrigeration Wholesalers
Air Conditioning Associates Inc
Air Conditioning Contractors of America
Air Conditioning Suppliers Inc
Air Products & Chemicals Inc
Airflow Company
Airtrol Supply Inc
Allan Equipment Company
Allied Protective Coating Inc
Allied Supply Company Inc
Allied Signal Corporation
Allred's Inc
Amana Refrigeration Inc
American Association of Meat Processors
American Convenience Products Inc
American Frozen Food Institute
American Gasket and Rubber Co
American Meat Institute
American Petroleum Institute
American Society for Hospital Center Personnel
American Standard Inc
American Supply Association
Amesbury Industries
Amico Foam Products Company
[illegible] Insulations Inc
Anderson Bros. Refrigeration Service Inc
Andrew A. Morris & Associates Inc
Andy's Refrigeration and Air Conditioning
Anscott Chemical Industries Inc
Arizona Refrigeration Supplies Inc
[illegible] Equipment Corporation
Arrow-Rasco Inc
Ashland Chemical Company
Associated Supply Co. Inc
Association of Home Appliance Manufacturers
Atochem
Authorized Supply Corp
Automatic Switch Co
B&H Pizza Company Inc
B&H Urethane Systems Inc
B.F. Goodrich Chemical Group
Baker Bros. Inc
Bally Case & Cooler Inc
Bard Manufacturing Co
Basic Industries Inc
Beltway Heating & Air Conditioning
Beverage-Air (Tannetics Inc)
Blue M—A Unit of General Signal
Bohn Heat Transfer
Bros Air Service Company Inc
Booth Refrigeration
Bramec Corporation
Branson Ultrasonic Corp
Bristol Compressors
Burke Engineering Co
Burton Plating Co
Burton-Dixie Corporation
Butler Refrigeration Co
Cahill Service Inc
California Cooling Supply Company
Capitol Refrigeration Company Inc
Carnation Company
Carrier Corporation
Cassady Supply Co. Inc
Celotex Corporation
Central Cooling Company Inc
Central Ohio Heating & Air Conditioning
Cervite Industries Inc
Chase Supply Company
Chemical Manufacturers Association
Chemical Packaging Corp
Chemical Specialties Manufacturers Association
Chemtech Roofing & Insulation Systems Inc
Chesebrough-Pond's Inc
Circle Arrow Urethane Systems Inc
Climate Engineering Inc
Clinton Chemical Company
[illegible] Specialty Inc
Columbus [illegible] Inc
Commercial Distributing Co
Commercial Refrigeration
Continental Research Corporation
Copeland Corporation
Cornelius Company
Creative Urethanes Inc
Crescent Manufacturing Company
Crest Industries Inc
Crown Refrigeration Supply Co
DK Engineering Inc
DP T&D and Associates
Davis & Frost Industrial Supply
Davidson Rubber Division
Davidson Supply Company
Dax Supply Company
Dennis Supply Company
Deshler Mechanical Corp Inc
Discount Insulation and Roofing
Distributors Inc of Colorado
Dixie Packaging Corporation
Domestic Sales Corporation
Douglas Barrett Inc
Dow Chemical U.S.A.
Duncan Supply Company Inc
Dunham-Bush Inc
[illegible] Inc
E.I. du Pont de Nemours and Company
EPRI
Ebco Manufacturing
Eggert Company
Elliott Williams Company Inc
Elliott Co. of Indianapolis Inc
Emerson Electric Company
En-Tech Inc
Engineering and Refrigeration Inc
F.E. Winstel Company
F.H. Langsenkamp Co. Inc
Falcon Safety Products Inc
Fallek Chemical Company
Fixturcraft Inc
Flex-O-Lators Inc
Flick Supply Company
Florida Containers Inc
Fluid Packaging Company Inc
Foam Applications Inc
Foam Enterprises Inc
Foam Insulation Contractors
Foam Systems Co
Foamseal Inc
Follett Corp
Fomo Products Inc
Food Marketing Institute
Forma Scientific—Div. of Mallinckrodt Inc
Fort Howard Paper Company
Fox Appliance Parts of Augusta
Fox Service Co. Inc
Fras-Air Contracting
Free-Flow Packaging Corp
Freeman Chemical Corporation
Frigoscandia
G&O Thermal Supply Company
G.B.H. Fabricating & Packaging Inc
GTE Products Corporation
Gabriel Manufacturing Company Inc
Galileo Electro Optics Corporation
Ganser Inc
Gas Appliance Manufacturers Association Inc
Gebauer Chemical Company
Geldbach Refrigerator Co. Inc
General Electric Company
General Heating & Cooling
General Motors
General Radio & Electronics Co
General Refrigeration Supply Company Inc
Genesee Refrigeration
Genpak Corporation
Gilbert Foam Insulation Co. Inc
Gilman Corporation
Glas-Craft Inc
Goettl Air Conditioning Inc
Great Lakes Chemical Corp
Great Lakes Systems Inc
Greenberg Supply Company Inc
Grocery Manufacturers of America
Gusmer Corporation
H.C. Duke & Son Inc
H.H. Robertson Company
H.M. [illegible] Company
Hackney Bros Body Co
[illegible] Products Corporation
Hansen Supply Co. Inc
[illegible]
Harold Electric Co
Harris Environmental Systems Inc
Harris-Teeter Supermarkets
Harry Alter Company
Hart & Cooley
Hearth Industry Manufacturers Association
[illegible] Manufacturing Company
[illegible] Chemicals
Hill Refrigeration Corp
Hill and Knowlton
Hinshaw Supply Company
Hobart Corporation
[illegible] Inc
[illegible] Refrigeration Supply Inc
Howard McCray Refrigerator Company Inc
Hussmann Refrigerator Corporation
Hyatt Hotels Corporation
IBM Corp
ICI Americas
IPS Services Incorporated
ITT Continental Baking Company
ITT Telecommunications
Igloo Products
[illegible] Corporation
[illegible] Inc
Illinois Supply Company
Imperial Electric Inc
[illegible] Inc
Inasco Incorporated
Independent Refrig. Supply Inc
Industrial Coatings Inc
Industrial Hydrocarbons Inc
Industrial Paper Distributors
Insco Distributing
Insport Industries Inc
Insta-Foam Products Inc
Institute of Heating & Air Conditioning Industries
Insulated Roofing Contractor—Div. of Urethane Kentuckiana Inc
Insulteck Corporation
International Association of Refrigerated Warehouses
International Cold Storage Company Inc
International Mobile Air Conditioning Assoc
J&P Supply Co. Inc
J. Reid Gaskins Co
J.R. Simplot Company
Jamison Door Company
John F. Harkins Company Inc
Johnson Controls Inc
Jordon Supply Company Inc
Keyes Fibre—Foam Division
Keyes Refrigeration Inc
King & Prince Seafood Corp
King-Wesler Equipment Co. Inc
Kuldaire Supply Company
Kroger Company
Kuss Corporation
La Roche Chemicals
Lars Refrigeration
Larkin Coils Inc
Lear Siegler Inc. Transport Dynamics Division
Leggett & Platt Inc.—Urethane Foam Division
Lennox Industries Inc
Lewis Corporation
Linford Service Co
Lintern Corporation
MARVCO—Remac Inc
Mammoth—A Nortek Co
Manitowoc Equipment Works
Manville Sales Corporation
Marin Tek Inc
Martin Insulation Inc
Mason Supply Co
Master-Bilt Products
McCoy Electronics Co. Subsidiary of Oak Industries Inc
McGee Industries Inc
McKesson Chemical Co. Foremost-McKesson Chemical Group
Mechanical Maintenance Company
Mechanical Service Corporation
Mechanical Supply Company
Meier Supply Co. Inc
Melcor Armstrong Dessau Inc
Metal Building Maintenance Company
Metro Refrigeration Supply Inc
Michiana Urethanes Inc
Micro Care Chemical Corp
Mid-City Supply Company Inc
Midwest Component Sales Inc
Miller Picking Corporation
[illegible] Inc
Mobay Chemical Corporation
Modern Engineering Co
[illegible] Sales Inc
Morris Trade Service Agency
Motor Vehicle Manufacturers Association
Murray Corporation
NAHB Research Foundation Inc
NCH Corporation
[illegible]
Nabisco Inc
National Association of Home Builders
National Automobile Dealers
National Commercial Refrigeration
National Fire Protection Assn
National Refrigerants Inc
Newark Auto Products Mfg Inc
Noble Refrigeration Supplies
[illegible] Paper Corporation
North Texas Air World Inc
Northern Packaging Products Co
Northern Weathermakers Inc
Northland Corporation
Norton Company
Omega Chemical Corp
Orb Industries Inc
Ore-Ida Foods Inc
Owens-Illinois
P&M Supply Inc
Pameco-Aire
Parker Hannifin Corp
Patterson Frozen Foods Inc
Peerless Pacific
Pennwalt Corporation
Pensacola Refrigeration Supply Inc
[illegible] Halladay Associates Inc
Pet Incorporated
Pioneer Supply Company
Plumb Supply Company
Polythane Systems Inc
Polyurethane Foam Association
Powers Service Company Inc
Precision Valve Corporation
Pride Solvents & Chemical
Quadrex HPS Inc
Quaker Oats Company
R&H Supply Company
R&R Supply Company
R.D. Marshall & Company
R.L. Hartley Corporation
RIP Inc
RPC Industries
Racon Inc (Essex Chemical Corp)
Radobenko Distributing Co. Inc
Ralph Wright Refrigeration
Rawn Company Inc
Recticel Foam Corp.—Morristown Foam Co
Reeves Refrigeration & Heating Supply Inc
Refrigeration & Electric Supply Co
Refrigeration Engineering Inc
Refrigeration Heating Inc
Refrigeration Research Inc
Refrigeration Sales Co. Inc
Refrigeration Service Engineers Society
Refrigeration Suppliers Corp
Refrigeration Suppliers Inc
Refrigeration Supplies Inc
Refrigeration Supply Co. Inc
Resco Inc
Rhode Island Refrig. Supply Co. Inc
Ritchie Engineering Company Inc
River Valley Foods Inc
Rmax Inc
Robinair
Rogers Supply Company
Rovanco Corporation
S & S Sunlimited Inc
S. Eisenberg & Company
Safer Prints Inc
Sanford Semchas & Speights Inc
Sara Lee
Scatena York Company
Schroeder Refrigeration Corp
Sealed Unit Parts Co. Inc
Service Parts Co
Service Supply Company
Service Supply of Victoria Inc
Service Supply Inc
Sexton Can Company
Sid Harvey Industries Inc
Simons Company
Single Service Institute
Singleton Seafood Co
Sirrine Environmental Consultants
Snyder General
Society of the Plastics Industry
South Central Co. Inc
South Texas Urethane Inc
Southern Refrigeration Corp
Southern Supplies
Southland Corporation
Southwest Manufacturing
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Taylor Freezer
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Tech Spray Inc
Tecumseh Products Company
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Texas Chemical Company
Texas Instruments
Texas Urethanes Inc
Textile Chemical Company
[illegible]
The 3M Company
Thermal Company Inc
Thermal Products Inc
Thermal Supply Inc
Thermo King Corporation
[illegible] Inc
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Thorpe Supply
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Trane Company
Treasure Isle Inc
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Twin City Supply Company
Tyler Refrigeration Corp
U.S. Industries
U.S. Urethane Inc
Uniflow Manufacturing Company
United Refrigeration Inc
Universal Applicators Inc
Urethane Chemical Company
Valcour Incorporated
Van Waters & Rogers—Subsidiary of Univar Corp
Van Wall Urethane Contractors Inc
[illegible] Corporation
Virginia Chemical Inc
Vollrath Refrigeration Inc
Voltek—Division of Sekisui America
Vulcan Materials Company
W.A. Brown & Son Inc
W.A. Roosevelt Company
W.M. Barr and Company
W.R. Grace & Co
WCI Appliance Center
Warm Springs Enterprises Inc
Warren Chemical Co. Inc
Warren Sherer—Division of Kysor Industrial Corp
Warwick Operating Corporation
Wawa Inc
Wayne Dennis Supply Company
Wei T.O. Associates Inc
Westfield Refrigeration & Air Conditioning Company
Whalen Company
White & Shauger Inc
William F. Nye Inc
Williamson Company
Wilson Refrigeration & Electric Inc
Wittichen Supply Company
Wm. Wurzbach Co. Inc
Woodward Governor Company
Worthington Cylinder
York International Central Environmental Systems Inc
York International Corporation
Young Supply Company

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Exhibit III

UNITED NATIONS ENVIRONMENT PROGRAMME
PROGRAMME DES NATIONS UNIES POUR L'ENVIRONNEMENT

IEO/DIE

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IMPLEMENTATION OF THE MONTREAL PROTOCOL

INFORMAL CONSULTATIVE MEETING WITH INDUSTRY
8 MAY 1990 - GENEVA

Draft Summary Report

Dr Tolba, UNEP Executive Director, convened a consultative meeting with the various industry sectors concerned on 8 May 1990 in Geneva. Representatives from Governments were also present. This meeting was a follow up to the exchange of letters between the UNEP Executive Director and the ICC Secretary General. The list of participants to the meeting is attached in annex.

The following main points were presented during the meeting:

I. Introduction and meeting objectives

Dr Tolba welcomed the participants to the meeting. He underlined that adequate technology transfer was crucial to the successful implementation of the Montreal Protocol. In the framework of the open ended working group of the parties to the Montreal Protocol, the elements of a financial mechanism to cover costs which will be encountered/occurred by developing countries to implement the Protocol have been identified. In parallel, it is necessary to discuss the issue of technology transfer which contains two basic elements: first the access to and use of patents and intellectual properties and second, access to and use of know-how related to the technology. The objectives of the meeting was to discuss industry's involvement in the technology transfer process.

Mr Faulkner, ICC Secretary General, underlined industry commitment to help in the implementation of the Protocol, applauded the UNEP Executive Director's leadership in this field and thanked him for having organized the meeting.

Mr Fry, IEB Director, who had been involved in the organization of the meeting, suggested that the representatives of the different industry sectors present their views and respond to Dr Tolba's and the Government representatives' questions.

II Priorities for technology transfer

Kevin J. Fay, Executive Director of the Alliance for Responsible CFC Policy presented the Alliance, which is a coalition of CFC user and producer industries in the United States.

He suggested the following priorities for technology transfer on the ozone depletion issue:

1. Recycling, reclamation and conservation technology - technologies to reduce the emission of current CFC compounds was the best opportunity

in the short-term to reduce CFC usage and is where the developing countries are placing their first efforts; 30% reduction in CFC use should come from those efforts;

2. Current not-in-kind substitution of products and processes - to replace CFC usage with currently available non-CFC technologies, such as aqueous cleaning and some foam blowing applications; again 30% reduction in CFC use should come from those efforts;

3. Utilization of new compounds - technology to use the compounds under development such as HFCs and HCFCs (which requires in many cases longer-term research, research on ancillary products or technologies, and large scale capital investment);

4. Production Technology for new compounds - to allow for research into the most efficient production processes, identification of most appropriate compounds (based on user input), and development of efficient, safe, and environmentally acceptable production processes.

It was pointed out that these steps are not necessarily mutually exclusive of each other but that they were ordered in a manner consistent with the time required to complete the development of the technologies for transfer. Mr Fay urged that this priority of technologies should be included in the UNEP report and that the industry was prepared to discuss concrete steps on means of disseminating data and technology where possible.

III. Cleaning industry and electronics industry

Mr Baxter presented the Industry Cooperative for Ozone Layer Protection, ICOLP, which is a cooperative organization of companies and the US/Environmental Protection Agency (US/EPA) which has open membership to all companies and organizations interested in Ozone Layer Protection. Members will encourage the prompt replacement of CFCs through safe and environmentally acceptable substitutes or technologies. Members will also make available non-proprietary, CFC alternative information that will be available through technology transfer workshops, on-line in an electronic data base, or through guide books which will be jointly published with the US/EPA.

ICOLP has already received an electronics cleaning technology from Digital Equipment Corporation that is now available to the world. Other areas will be covered in the Technical Guide Books which are planned to be ready during the next year, including:

Aqueous and Semi-Aqueous Alternatives to CFC-113

Inert Gas Soldering Alternatives to CFC-113
Low Solids Flux Alternatives to CFC-113
Riveting without CFCs
CFC and Methyl Chloroform Solvent Containment
Precision Cleaning without CFC or Methyl Chloroform

ICOLP will make its information available in a variety of ways to make it easy for users to access it. An on-line data base will allow direct access, print outs, or down loaded diskettes. Workshops will provide face to face information exchange, and the guide books will be available to all in the whole world to copy and use.

Dr Paul A. Cammer, President of the Halogenated Solvents Industry Alliance (HSIA) in the USA, presented its "Center for emissions control" which is currently collecting all available information on emission reduction technology and techniques. This information will be made available worldwide.

IV Foam industry

Mr Hubert Creyf, of Europur (the European Association of Flexible Polyurethane Foam Blocks Manufacturers) recalled that the normal blowing agent for these foams is carbon dioxide (CO_2), in situ generated as a reaction product from water and polyisocyanates (raw materials). However this reaction is rather exothermic and introduces hard segments into the polymer. This practically means that in the lower densities (eg. 22 kg/m^3 and lower) an extra blowing agent is necessary. In the past, especially CFC 11 (CCl_3F) has been used. The technical possibilities to replace CFC 11 are:

1. The use of an alternative "extra" blowing agent: eg. methylene chloride (MC). Extra precautions have to be taken with the ventilation of the production area, as the allowed concentration of MC is 100 ppm, whereas 1.000 ppm of CFC is allowed. The change in formulation is small and can be given free by suppliers of MC (eg. DOW, ICI, AKZO, ...)

2. Increase of foam density: from what was said above, one can avoid the use of an "extra" blowing agent, by refraining from foaming low density foams. There are no installation costs linked to this, but the foam will be more expensive (it is sold at a kilo price per volume). The quality of the foam is proportioned to the density.

3. Chemical changes in raw materials: raw material suppliers have been working on changes in the structure of the raw materials, so that CFCs can partly be dropped. This technology is directly available from the raw material suppliers (Union Carbide, Bayer, Dow, Goldschmidt, Mobay, ...). The research in this field is going on.

4. CFC recovery: today only a few plants use this technology (adsorption on active carbon, and recovery with steam). It is considered to be an expensive technology, which asks for a high level technical surrounding.

5. AB-technology: in this technology a formiate salt is added to the raw materials, which yields a mixture of CO and CO_2 as an

auxiliary blowing agent. It does not totally exclude the use of CFCs in the lower densities. The technology is owned by a Belgian foamer (Câbleries d'Eupen), and conditions have to be negotiated with this firm. The foam plant has to be slightly modified (investment ± US$ 50.000), and some changes in formulation are necessary.

Mr Paul Ashford, European Phenolic Foam Association, indicated that the phenolic foam technology had been transferred by patents; development using CFC free alternatives will be transferred free of charge within existing licences.

V. Aerosols

Mr Kurt Bernhard, Technical Director, Pamasol, indicated that technologies were available to replace the use of CFCs in aerosol production:

1. use of hydrocarbons, which in fact is less costly than CFC
2. use of HCFC 22.

Information on these technologies is available.

VI Refrigeration

- On behalf of ARI (the Air-Conditioning and Refrigeration Institute), Mr James M. Calm indicated that the technology transfer needs for air-conditioning and refrigeration can be separated into three areas:
  - thermodynamic and transport properties of substitute refrigerants: data area already available for a number of alternative refrigerants, and development of the missing data is either underway or planned. These data will be available through various publications including those of the American Society of Heating, Refrigerating, and Air-Conditioning

Engineers (ASHRAE), International Institute of Refrigeration (IIR), and Japan Association of Refrigeration (JAR). Chemical producers also supply such data in bulletin and software form. Several property programmes are available (and are being expanded); an example is REFPROP, the National Institute of Standards and Technology (NIST) Refrigerant Property "database". This programme runs on desktop computers and is available to all interested parties, including those from developing countries, for a nominal ($225) licensing fee.

materials compatibility and lubricant property information: the lack of data in these areas has been identified by our industry as a significant impediment towards utilization of alternative refrigerants. Rer arcn programmes are underway by refrigerant, lubricant, materials, component, and equipment manufacturers. Many of the results are being included in the Air-Conditioning and Refrigeration Institute (ARI) Refrigerant Database. ARI has made arrangements for and co-funded distribution of Refrigerant Database documents through NIST. They are available to tall interested parties in developed and developing countries, as an industry initiative to accelerate consideration and utilization of alternative refrigerants. A summary of the Refrigerant Database was distributed at the meeting. Updates of the summary will be made available to interested parties upon request. Whereas the Refrigerant Database provides interim results to accelerate CFC phase out, a comprehensive Materials Compatibility and Lubricant Research programmes has been proposed in the United States. Subject to anticipated co-funding by government and industry, the multimillion-dollar research effort will provide comprehensive data on the subject. If the programme proceeds as planned, the results will be made available to the public, without limitation. Individuals and companies in the less-developed countries should gain access to the results at the same time as others in developed countries.

- product and manufacturing technologies: the pertinent technologies are generally highly competitive -- both domestically and internationally -- and proprietary. Licensing arrangements and joint ventures offer appropriate bases for transfer of such technologies. Several developing countries (notably Brazil, China, India, and Mexico) already are very active in production of components and/or products under such arrangements. There is no reason to believe that technology transfer will be limited, and international competition will assure continued access to these technologies. Furthermore, numerous students from developing countries attend universities in developed countries and participate and gain experience in research of these technologies.

Industry is willing to share the refrigerant property information, Refrigerant Database, materials compatibility and lubricant research results, and other information with less-developed countries; a fair amount of information is already available. UNEP must assist in assuring that all countries participate in such sharing to accelerate phase out of CFCs in both developed and developing countries. Without international co-operation and participation, the companies now providing technical information may discontinue their sharing in order to remain competitive in the developed countries.

- Mr D. Clodic, Ecole des Mines de Paris, suggested that CFC free refrigeration systems were available and should be developed, such as adsorption systems or ammonia based systems. More research was also needed, and money should be made available to developing countries to research centres working in this area.

- Mr Gac, Director of the International Institute of Refrigeration, suggested a number of actions to reduce CFC use in the refrigeration field (CFC recovery, CFC conservation, use of CFC free refrigerants). This institute is ready to disseminate the results of research through its bibliographic database FRIGINTER.

V. Chemicals production

Mr William M. Corcoran, Allied Signal Inc., Mr Mike R. Harris, ICI, Mr Maurice Vernille, Atochem, Mr Tony Vogelsberg, Du Pont, Mr Joachim von Schweinichen, Montefluos, presented the CFC producers points of view. From their statements and their responses to the UNEP Executive Director, the following general points emerged:

- HCFC 22 technology is forty years old and most CFCs producers in LDCs produce it. So the technology of substitution with new products only really apply to 20% worldwide of existing CFC production.

- Transfer of production is part of the producers strategies in order to meet consumer demand in the different parts of the world through:

    - licencing of a company
    - joint ventures

- These agreements have always taken place between companies; most of the CFCs plants in the developing world are the result of such strategies since 40 years.

- The same principle will apply to technologic transfer for HFCs and HCFCs more rapidly because the market already exists and companies will be fighting for shares of that market in an highly competitive environment.

- The still very experimental nature of the new technology - with associated risk - inhibits management to consider, even now, such transfer.

- Exports from the first generation plants will bridge the period during which the technology will be consolidated. It will allow local user industry to establish local downstream technologies.

- During that transition period export will obviously be supported by technical assistance - at no extra cost to the customer - as is the case for CFCs.

- It is a general principle, in the chemical industry, that only such technology will be transferred if all the safety rules have been established and can be complied with by the operating company (examples: HF, HCI, olephinic impurities...)

- Competitive transfer of technologies, following these principles, will likely take place starting around the year 2000 allowing local producers to choose between different technologies and different substitutes.

- HFC 134a, a likely significant alternative is being pursued for possible commercialization by at least ten separate companies; suggesting very competitive supplies to all of the world's users.

- Normal business considerations will determine the cross choice of partner(s).

- The CFCs and potential substitutes producers, because of their knowledge of the application technologies, are willing to support every initiative for information of LDC users for the transfer of downstream technologies (physical and technical data supply, technical contributors to seminars ...)

In addition, Mr Vogelsberg presented Du Pont's CFC technology transfer practices:

- provided technology and capital investment for joint ventures in Brazil, Mexico and Argentina. The technology and safety features have been continually upgraded at Du Pont's expense.

- no CFC technology has been sold by Du Pont and it is unlikely that near term Fluorocarbon Technologies sales will occur.

- Du Pont has global interests and is interested in supplying alternative Fluorocarbons at competitive world prices to all markets and regions. Use technology is part of their technical sales effort to assure customers are efficient and cost competitive when using their chemicals.

- Technology for local manufacture will be available on a business basis if it can be structured so that there are long term benefits to Du Pont and the foreign partner; and there is mutual respect for proprietary know-how as well as environmental and safety aspects of plant operation.

He also gave the following elements about plant economics:

- plant investments and unit costs per kilogram rise very sharply below about 5-10 M metric tons/yr capacity.

- technical resources will be limited over the decade of the 90's and very heavily committed to retrofitting existing CFC plants around the world. It takes the same technical resource effort to design and build a 5 m ton/yr plant as it does for a 50 m ton/yr unit.

- plants frequently must be increased in size to permit competitive export sales as well as meeting domestic needs to assure economic scale of operation.

VIII. Conclusion of the meeting

Dr Tolba thanked the participants for their most valuable comments and input. He indicated his wish to continue the discussions with CFCs producers on the financial aspects of technology transfer in this area. It was decided that a small working group composed of a few industry and government representatives would convene in the afternoon to suggest an input to the articles dealing with transfer of technology in the proposed amendment to the Montreal Protocol.

In addition, as there was no time available to discuss industry's proposals to organize seminars and programmes of visits to industrial facilities, it was decided that another informal consultative meeting be organized in London on 19 June 1990, immediately before the Second Meeting of the Parties to the Montreal Protocol.

Annex

Implementation of the Montreal Protocol

Informal Consultative Meeting with Industry

8 May 1990 - Geneva

LIST OF PARTICIPANTS

Mr Paul Ashford	Spokesman on CFC's issues European Phenolic Foam Association c/o B.P. Chemicals Ltd Sully, Nr. Penarth South Glamorgan, CF6 2YU United Kingdom
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Mr Kurt Bernhard	Technical Director Pamasol Willimader AG Driesbuhlstr. 2 Postfach 8808 Pfaffikon SZ Switzerland
Mr G. Victor Buxton	Environment Canada Ottawa, Ontario Canada
Mr James M. Calm	Director of Research & Technology Air-Conditioning & Refrigeration Institute 1501 Wilson Boulevard, 6th floor Arlington, Virginia 22209-2403 U.S.A.
Mr Paul Cammer	President Halogenated Solvents Industry Alliance 1225 19th Street, Suite 300 Washington, D.C. U.S.A.

Ms Eileen Claussen	Environmental Protection Agency Washington, D.C. U.S.A.
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Mr William M. Corcoran	Director of Public Affairs Allied Signal Inc. P.O. Box 10872 Morristownship, New Jersey 07960 U.S.A.
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Mr Hugh Faulkner	Secretary General International Chamber of Commerce 38 Cours Albert-Ier 75008 Paris France
Mr Kevin Fay	Executive Director Alliance for Responsible CFC Policy 2011 Eye Street Suite 500 Washington, D.C. 20006 U.S.A.
Mr Albert E. Fry	Director International Environmental Bureau 61 route de Chêne CH 1208 Geneva Switzerland
Mr Gac	Director Institut International du Froid 177 bd Malesherbes 75017 Paris France
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Mr Valter P. Moreira	Counsellor Ministry of External Relations - Brazil Brazilian Mission in Geneva Switzerland
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AIR-CONDITIONING
& REFRIGERATION
INSTITUTE

RECEIVED MAY 2 9 1990

Representing Manufacturers
of Heating, Ventilating,
Air-Conditioning and
Refrigeration Products

17 May 1990

Mme. Jacqueline Aloisi de Larderel
Director, Industry and Environment Office
United Nations Environment Programme
Tour Mirabeau
39-43, quai André Citröen
F-75739 Paris, Cédex 15
France

Dear Madame Aloisi de Larderel:

Pursuant to your request, following Dr. Tolba's consultative meeting on transfer of technology related to implementation of the Montreal Protocol, this letter summarizes the comments that I offered with regard to the air-conditioning and refrigeration industry. This industry as one of the major technology areas currently using and seeking substitutes for chlorofluorcarbons (CFCs).

The technology transfer needs for air-conditioning and refrigeration can be separated into three areas:

- thermodynamic and transport properties of substitute refrigerants: Data are already available for a number of alternative refrigerants, and development of the missing data is either underway or planned. These data will be available through various publications including those of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), International Institute of Refrigeration (IIR), and Japan Association of Refrigeration (JAR). Chemical producers also supply such data in bulletin and software form. Several property programs are available (and are being expanded); an example is REFPROP, the National Institute of Standards and Technology (NIST) Refrigerant Property "database". This program runs on desktop computers and is available to all interested parties, including those from developing countries, for a nominal ($225) licensing fee.

- materials compatibility and lubricant property information: The lack of data in these areas has been identified by our industry as a significant impediment towards utilization of alternative refrigerants. Research programs are underway by refrigerant, lubricant, materials, component, and equipment manufacturers. Many of the results are being included in the Air-Conditioning and Refrigeration Institute (ARI) Refrigerant Database. ARI has made arrangements for and cofunded distribution of Refrigerant Database documents through NIST. They are available to all interested parties in developed and developing countries, as an industry initiative to accelerate consideration and utilization of alternative refrigerants. A summary of the Refrigerant Database and the available documents was distributed at the meeting; a copy also is attached. Updates of the summary will be made available to interested parties upon request.

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Whereas the Refrigerant Database provides interim results to accelerate CFC phase out, a comprehensive Materials Compatibility and Lubricant Research program has been proposed in the United States. Subject to anticipated cofunding by government and industry, the multimillion-dollar research effort will provide comprehensive data on the subject. If the program proceeds as planned, the results will be made available to the public, without limitation. Individuals and companies in the less-developed countries should gain access to the results at the same time as others in developed countries.

- product and manufacturing technologies: The pertinent technologies are generally highly competitive -- both domestically and internationally -- and proprietary. Licensing arrangements and joint ventures offer appropriate bases for transfer of such technologies. Several developing countries (notably Brazil, China, India, and Mexico) already are very active in production of components and/or products under such arrangements. There is no reason to believe that technology transfer will be limited, and international competition will assure continued access to these technologies. Furthermore, numerous students from developing countries attend universities in developed countries and participate and gain experience in research of these technologies.

Industry is willing to share the refrigerant property information, Refrigerant Database, materials compatibility and lubricant research results, and other information with less-developed countries; a fair amount of information already is available. UNEP must assist in assuring that all countries participate in such sharing to accelerate phase out of CFCs in both developed and developing countries. Without international cooperation and participation, the companies now providing technical information may discontinue their sharing in order to remain competitive in the developed countries.

Please let me know if any further information is needed. With best regards,

Sincerely,

James M. Calm
Director of Research and Technology

enclosure: Refrigerant Database Summary (17 April 1990)

cc: E. Claussen, EPA
B. Corcoran, Allied-Signal
K. Fay, CFC Alliance
A. Fry, IEB
M. Harris, ICI
M. Tolba, UNEP
M. Verhille, Atochem
T. Vogelsberg, Du Pont

via telefax: 33-1/40.58.88.74 FAXED: 17 MAY 1990, 11:15 AM

REFRIGERANT DATABASE

Objectives

- Develop a database of information on substitutes for controlled chlorofluorocarbon (CFC) refrigerants for air conditioners, heat pumps, refrigeration equipment, appliances, and insulation production
- Assemble property, materials compatibility, lubricant, test, and related data for these refrigerants along with comparative data for currently-used refrigerants
- Make the data readily accessible, as quickly as possible, for screening and evaluation of alternative refrigerants and for equipment design

Status

Information from documented tests and studies by industry; results from public-sector research; and data obtained through a search of published literature are being assembled. The database addresses compatibility, solubility, and stability data as well as thermodynamic, transport, flammability, and explosivity properties; toxicity data are not included. Some of the information, both qualitative and quantitative, is incomplete and/or based on tests that are not yet standardized. The *best available* information is being included, until more rigorous or detailed data can be obtained, to accelerate consideration and introduction of alternative refrigerants. Abstracts of included documents are being prepared to facilitate identification of documents that may be pertinent to specific user needs.

The database project was initiated on 14 April 1989 with a request by ARI for data submission. The following items have been received:

Atochem North America, Incorporated (Pennwalt Corporation)

- *Isotron 22/142b Blends for Refrigeration: Material Compatibility*
- *Isotron 141b Foam Blowing Agent: Material Compatibility*
- *Flammability Characteristics of Isotron 141b*
- *Results of Testing: Limits of Flammability for Isotron 141b*
- *Results of Testing: Flashpoint of Isotron 141b*
- *Results of Testing: Maximum Rate of Pressure Rise - Maximum Explosion Pressure of Isotron 141b*
- *Flammability Characteristics of Isotron 142b*
- *Results of Testing: Limits of Flammability for Isotron 142b*
- *Results of Testing: Flashpoint of Isotron 142b*
- *Results of Testing: Maximum Rate of Pressure Rise - Maximum Explosion Pressure of Isotron 142b*

Carrier Corporation

- *Solubility of R-123 and R-134a in Oils* [solubility curves for R-123 with Mobil DTE 26 and Mobil DTE Heavy Medium oils and critical solution temperatures for R-134a with unidentified 300 and 750 SUS polyglycol oils]
- *Motor Materials in R-123 and R-134a* [compatibility of R-123 and R-134a with motor insulation varnishes XV-572, XV-587, Isopoxy 800, Dolphon Polyester, and Sterling U-475]
- *UL 984 Tests with R-123 and Oils* [current-leakage and breakdown-voltage tests of motor materials alone, R-11 and R-123 with 5% Mobil DTE 26, R-11 and R-123 with 5% Zerol 150, and R-11 and R-123 with 5% Rando HD68]

- *UL 984 Tests with R-134a and Oils* [current-leakage and breakdown-voltage tests of motor materials alone, R-12 and R-134a with Suniso 3GS, and R-134a with Zerol 150]
- *Polymer and Elastomer Performance in R-123 and R-134a*
- *Decomposition Rates of R-11 and R-123*
- *Sealed-Tube Tests of R-123 and R-134a with Mineral Oils*
- *Sealed-Tube Tests of R-12 and R-134a with PAGs*

Copeland Corporation

- *Evaluation of Polyalkylene Glycol Candidates with HFC-134a in Refrigeration Compressors*

E. I. du Pont de Nemours and Company, Incorporated

- *Alternative Refrigerant Blends*
- *Experimental Details: Elastomer Compatibility with HFC-134a*
- *Compatibility of Elastomers with HFC-134a at About 25°C*
- *Solubility of Refrigerants in Lubricants: HFC-134a*
- *Compatibility of* [H]*FC-134a with Refrigeration System Materials*
- *Thermodynamic Properties of* [HC]*FC-123* [tabular and graphical estimates of thermodynamic properties, for saturated and superheated conditions, based on estimated critical properties and Redlich-Kwong equation-of-state calculations; the equation is presented for subsequent use]
- *Thermodynamic Properties of* [H]*FC-134a* [tabular estimates of thermodynamic properties, for saturated and superheated conditions, based on Redlich-Kwong equation-of-state calculations]
- *Plastic Immersion Tests for Fluorocarbon-123* [experimental results for short-term immersion and thermal-aging of 13 plastics in HCFC-123; the plastics tested included linear polyethylene Alathon 7050, polypropylene Alathon 9140, polypropylene Alathon 9140, methylmethacrylate (cast) Lucite, nylon Zytel 101, TFE Teflon type 1, polycarbonate Lexan, ABS polymer Kralastic, polystyrene Styron 475, epoxy G-10-3675, ethyl cellulose, acetal Delrin 500X, polyvinyl alcohol, and polyvinyl chloride (unplasticized)]
- *Elastomer Immersion Tests for Fluorocarbon-123* [experimental results for short-term immersion and thermal-aging of 13 elastomers in HCFC-123]
- *Summary of Physical Property, Solubility, and Compatibility Data for* [HC]*FC-123* [provides property and compatibility data for R-123 including liquid density, vapor pressure, viscosity, surface tension, Kauri-butanol number, solubility of water, solubility of various substances, and effect on magnet-wire coatings]
- *Metal Corrosion Tests with* [HC]*FC-123 and Distilled Water* [compatibility of R-123 and distilled water with steel 1020 CR, stainless steel 304, nickel, monel, copper, aluminum 2S, zinc, and magnesium allow FS-1 under dry and wet conditions]
- *Compatibility of Alternative Refrigerants with Elastomers* [swell tests of Neoprene W and Buna NC in R-123 and R-124]
- *Mutual Solubilities of Water with Fluorocarbons and Fluorocarbon-Hydrate Formation* [solubility and hydrate-formation data for R-123, R-124, and R-125]
- *Disassembly and Inspection of Compressor in Laboratory Refrigerator Charged with R-134a* [long-term effects on a rolling-piston rotary refrigerator compressor operated for 8.7 years with R-134a and UCON LB-525; includes results of gas chromatography and chemical analysis of final refrigerant composition, metallurgical analysis, and photographic record of compressor disassembly including profilometer readings]
- *Ternary Refrigerant Blends for the Automotive Aftermarket*, Du Pont document ARTD-1 [test results for R-22/152a/114 (36/24/40) (blend KCD-9430) and R-22/152a/124 (36/24/40) (blend KCD-9433) for automotive use; concludes that the blends are not *drop-in* replacements for CFC-12, but that technologies exist or can be developed to accom-

plish retrofit while maintaining acceptable performance; topics covered include environmental impacts; toxicity; properties; flammability; compatibility data for hoses constructed of nylon, Hypalon 48, nitrile; compatibility data for elastomers including epichlorohydrin, neoprene, nitrile; compatibility data for molecular-sieve desiccants; and solubility and lubricity data for BVM-100N, Idemitsu, and Mopar mineral oils and Zerol 500 alkylbenzene oils, the last with three additives for the lubricity tests]

ICI Chemicals and Polymers Limited

- *Compatibility of Nonmetallic Materials with Refrigerants and Lubricants*

Oak Ridge National Laboratory

- *Comparative Refrigerant Performance*, draft[1] [R-12, R-22, R-32, R-114, R-124, R-125, R-134, R-134a, R-142b, R-143a, R-152a, R-218, and R-C318: at four standard heat pump rating conditions]

Spauschus Associates

- New Stability Test Methods for Alternative Refrigerants and Mixtures

Tecumseh Products Company

- *Materials Compatibility of R-134a in Refrigerant Systems*
- *Materials Compatibility of R-142b for Hermetic Units*

The Trane Company

- *R-123 Refrigerant Analyses* [purity including chloride-ion content, moisture content, high-boiling residue, organic purity determined via gas chromatography, and neutralization value determined for samples of R-123 from two producers and R-11 as a control]
- *Material Compatibility of Alternative Refrigerants* [R-11 and R-123 with red (Neoprene 2337) elastomer test rings]
- *Material Compatibility of Alternative Refrigerants* [R-11 and R-123 with yellow (Nitrile 7507), red (Neoprene 2337), and green (Neoprene 2167) elastomer test rings]
- *Material Compatibility of Alternative Refrigerants* [R-11, R-123, and 250 SUS white oil with yellow (Nitrile 7507), red (Neoprene 2337), and green (Neoprene 2167) elastomer test rings]
- *Material Compatibility of Alternative Refrigerant* [R-123 with polysulfide rubber ST elastomer]
- *Material Compatibility of Alternative Refrigerant 123* [with Reinz chloroprene sheet gasket material]
- *Material Compatibility of Alternative Refrigerant 123* [heat aging in air of Neoprene 2347 elastomer O-rings and fluid resistance tests with R-11, R-123, ASTM #3 oil, and 250 SUS white oil]
- *Material Compatibility of Alternative Refrigerant 123* [heat aging in air and R-11 vapor and liquid, R-123 vapor and liquid, ASTM #3 oil, and 250 SUS white oil of red (Neoprene 2337), green (Neoprene 2167), and a new-compound (Neoprene 2347) chloroprene elastomer O-rings and green (Neoprene 2167) chloroprene elastomer cord rings]
- *R-123 Refrigerant Analyses* [purity including moisture content, high-boiling residue, and gas chromatograph fingerprints compared for redistilled used, not distilled used, and new R-123 specimens]
- *Teflex O-Rings, Size 214, Sealmore Industries* [swell properties in R-11 and R-123 as well as each refrigerant with 250 SUS white oil]
- *HCFC-123 Compatibility with Teflex NPG V-214 O-Rings Covered with High Density Teflon* [swell testing after heat aging of the covered Viton O-rings in liquid and vapor R-123]
- *Stability of CFC-11 and HCFC-123* [in presence of 250 SUS white mineral oil with aluminum, copper, and steel at elevated temperatures]

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[1] A replacement version is anticipated.

- *Evaluation of Epoxy Varnish Materials for Alternative refrigerant HCFC 123* [thermal-aging tests in air, R-11, and R-123 for Sterling 364, Schenectady Isopoxy 800, Schenectady 8620, Epoxylite 477, and P. D. George 923 epoxy varnishes]
- *Viton O-ring and Cord Ring Swell Data in Both R-11 and HCFC-123*

UOP

- *Desiccants for Drying R-134a in Refrigeration Systems*[2]

York International Corporation

- *R-123 versus R-11 Performance Test*
- [R-123] *Compatibility Test – "O" rings, Gasket, Oil Filter, Etc.*
- [R-123] *Compatibility Test – Loctite Sealants (Pipe Sealant with Teflon, Grade AV)*
- [R-123] *Compatibility Test – 15# Carbon Bursting Disk (2.5")*
- [R-123] *Compatibility Test – Green-Colored Viton "O" Ring*
- *Sealed-Tube Stability Tests on Refrigeration Materials* by H. M. Parmelee, *ASHRAE Transactions*, January 1965 [includes data on numerous refrigerants, among them a limited amount on R-124]

The data will be distributed in the form received. Abstracts will be similarly provided in printed form, though a computerized retrieval system is contemplated if the volume of materials received justifies its preparation.

Investigators

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[2] A replacement version is anticipated.

revised 1May90

Mr. **Scheuer**. Thank you very much, Mr. Fay.

Now we will hear from Paul Cammer, President of the Halogenated Solvents Industry Alliance.

STATEMENT OF PAUL A. CAMMER, PRESIDENT, HALOGENATED SOLVENTS INDUSTRY ALLIANCE

Mr. **Cammer**. Thank you very much, Mr. Chairman.

I appreciate this opportunity, and perhaps your request for extemporaneous communication might be advanced by my failure to bring my glasses. Therefore I can't read my notes.

The Halogenated Solvents Industry Alliance, or HSIA, is a trade association of manufacturers and users of chlorinated cleaning solvents, including methyl chloroform. I really do appreciate this opportunity this morning and I would like to just summarize a few of our comments on the Montreal Protocol and methyl chloroform and how they relate, and some of our thoughts on technology transfer. I would also like to talk about how we feel the Protocol relates to pending Congressional action.

Very briefly, methyl chloroform is a very important solvent in metal cleaning, precision cleaning, and the electronics, aerospace, and automotive industries, and other industries. It is also very important in adhesives, coatings, aerosols, and as you probably know by now, the Montreal Protocol revision will call for, beyond adding methyl chloroform to the Protocol, it will call for a freeze in 1993, a 30 percent reduction in 1995, 70 percent reduction by 2000, and a complete phase-out by the year 2005.

This is for a chemical that has a relatively low ozone depletion factor, although as you know it was produced in significant quantities and therefore does contribute to atmospheric chlorine.

Now that controls are in place, however, for this compound and all the other compounds that are in the Protocol, it is critical that the number one objective be achieved and that is 100 percent compliance with the Protocol as it has been written. Now that the fund has been established for a couple hundred million dollars, for about three years, and it will probably go beyond that, there are a lot of questions being asked as to how that money should be spent.

That brings to, I assume, what is your most important question about technology transfer and how that is going to work. One of the most important things to realize is that technology transfer is an evolutionary process, as Kevin pointed out. Stepwise, it is evolutionary. It is not one of the things that you were alluding to, Mr. Chairman, and one of the other members earlier expressed some concern on the part of the developing countries, that they were not going to get the technology that they need.

Mr. **Scheuer**. At the price they think they need to pay.

Mr. **Cammer**. At the price they thing they need to pay, indeed. Part of it goes to, I think, failure to understand thoroughly the technology that is currently available, and the stepwise evolutionary fashion in which it needs to be transferred. We were a participant in that informal conference with Executive Director Tolba and developing countries. It was clear after that that the most immediate technology that needs to be transferred to the developing countries is not how to produce these new compounds that we are not even producing yet on a market scale in this country.

But rather, we need to inform them of technology that would reduce fugitive emissions, that would allow them to use these chemicals more efficiently, technology that would allow them to recycle them much better. We have found that there is a lot that can be done in operations of running a plant, a lot that can be done simply with minor technological changes that would significantly reduce the emissions and therefore consumption of these compounds.

For example, if you have a little degreaser, and you want to increase the distance between the top of the degreaser and the top of the solvent, you will find that you will be able to save a significant amount of solvent going into the air. Likewise, if you have a lot of open top degreasers, and you merely put a sliding cover on it, companies can save a lot of this stuff going into the air, and therefore, consumption, and it will allow the developing countries to comply with the Protocol much easier than if they did not have this type of technology and information.

Technology transfer, of course, is not limited to international affairs. There are 75,000 companies in the United States that use a significant amount of methyl chloroform, almost 25 percent of the U.S. manufacturing economy.

Do I believe that they all know the technology that is available to reduce emissions? No, I don't believe so. Do I think that they are all using these chemicals, methyl chloroform in particular, as efficiently as they possibly can? No, I do not believe so.

So I think the technology transfer does not need to necessarily start and finish at home, but we do need to include that domestic process as well as the international process.

Part of that effort is going to be achieved by HSIA member companies which are in the process of establishing a new entity called the Center for Emissions Control, the purpose of which is to collect and disseminate information on emissions control technology and recycling, etc., to all companies using chlorinated cleaning solvents, whether it is methyl chloroform or whatever. We are involved with some joint Government projects with the Department of Energy right now. We plan on joint sponsorship of workshops, and seminars, and so on around the country.

A lot of these efforts can be and should be expanded to the international effort.

I would like to turn now to our thoughts on the Clean Air Act and Congressional action that is pending in the conference coming up very shortly. The Montreal Protocol and the successful efforts to strengthen it have been widely recognized as the appropriate response to global environmental problems. The expanded Protocol will become part of U.S. law upon its ratification.

We do not believe, however, that the U.S. Congress should pass legislation that at best would duplicate an expanded Montreal Protocol, and at worst, subject U.S. companies to production controls and regulations more stringent than those imposed on companies operating in other countries. Unfortunately, both the Senate and the House versions of the revised Clean Air Act that will be going to conference very soon contain control schedules for methyl chloroform and other substances that differ significantly from the schedules in the new Montreal Protocol.

Unilateral action by Congress to control CFCs, halon, methyl chloroform and other substances would put U.S industry at a distinct competitive disadvantage compared to foreign companies that would be under less stringent restrictions. The effects of such unilateral action on methyl chloroform and the HCFCs will be particularly pronounced as U.S. companies in the electronics and aerospace industries, among others, will be deprived of products that their foreign competitors will be using in place of CFCs in many applications. This could lead to the export of jobs from the United States, as for example, firms move operations involving electronic assembly offshore.

It is entirely unrealistic to expect the U.S. manufacturing industry to develop new technologies without the same transitional phase during which substances with low ozone depletion potential could be available. Moreover, the stratospheric ozone titles of the House and Senate Clean Air Bills go further than simply modifying the control schedules in the Montreal Protocol. One or the other of these bills would prohibit the use of methyl chloroform or HCFCs in aerosol and plastic foam products after 1994.

Aerosol packagers and foam producers have increasingly relied upon methyl chloroform as a non-flammable, relatively non-toxic substance that does not contribute to smog. Foreign producers of these products will continue to be free to use methyl chloroform and HCFCs in these products after 1994.

The Clean Air bills contain other provisions dealing with consumer products labeling that would penalize U.S. users of methyl chloroform and HCFCs without producing significant environmental benefit. For example, methyl chloroform could no longer be used in making an undefined class of non- essential products under the House bill, even though foreign companies would be under no similar restriction under the Protocol. Such provisions would replace the free market with a bureaucratic framework that does not exist in other countries.

Now that the Protocol has been revised to provide a stringent control schedule resulting in total elimination of methyl chloroform, which has a relatively low ozone depletion potential, in just 15 years it cannot be seriously argued that a more rapid phasedown is necessary to save the environment. Indeed, more restrictive measures to control methyl chloroform could be counter-productive to our efforts to eliminate CFC use as rapidly as possible. It turns out that other alternatives to CFC usage are not developing as rapidly as anticipated.

Finally, I would like to return your attention to the Protocol and one of the new decisions that was made. That is that they have decided to meet again in 1992, not in 1994, and that in 1991 the technology review panel will be assessing the ability to get out of these control substances even quicker than mandated by the current new Protocol.

If after that assessment, the U.S. delegation, the U.S. Government, believes that the Protocol should be strengthened, if we take unilateral action here, that activity, taking action prior to going to the Party meeting in 1992, that unilateral action will weaken the

U.S. negotiating position and lessen our chances to achieve an international agreement on stronger control.

In closing, I would like to echo Dick Smith's admiration of the UNEP process, and the speed with which it has been able to act and react to incoming data. This industry has every confidence that it will proceed based on the data that are available, as quickly as possible, and that consequently, unilateral action by this country and between other countries is unnecessary.

Thank you.

[The prepared statement of Mr. Cammer follows:]

HSIA HALOGENATED SOLVENTS INDUSTRY ALLIANCE

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HSIA STATEMENT BEFORE THE SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION AND THE SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH, AND ENVIRONMENT OF THE HOUSE SCIENCE, SPACE, AND TECHNOLOGY COMMITTEE

Hearing on CFC Reduction -- Technology Transfer to the Developing World

Paul A. Cammer, Ph.D.
President

July 11, 1990

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STATEMENT OF THE
HALOGENATED SOLVENTS INDUSTRY ALLIANCE

Introduction

The Halogenated Solvents Industry Alliance (HSIA) represents producers and users of methyl chloroform (1,1,1-trichloroethane) and manufacturers of the equipment required for its safe and efficient use. HSIA has actively participated in the international efforts to amend the Montreal Protocol on Substances That Deplete the Ozone Layer to reduce production of chlorofluorocarbons (CFCs), halons, carbon tetrachloride, methyl chloroform, and hydrochlorofluorocarbons (HCFCs) as alternative materials with lower ozone depletion potential become available. In particular, HSIA supports efforts to obtain worldwide conformity with the Protocol.

Methyl chloroform is a solvent that is widely used for metal and precision cleaning in the electronics, aerospace, and automotive industries for both civilian and defense applications. It also has important uses in adhesives, coatings, and aerosols, where it is often the solvent of choice because of its technical properties. Methyl chloroform and the HCFCs under development as CFC replacements have ozone depletion potentials that are only a fraction of those of the CFCs. The HCFCs and methyl chloroform are the only alternatives to CFCs in many applications. Methyl chloroform is also a raw material for some of the HCFCs. Unlike most of the HCFCs, which are still under development, methyl chloroform has been extensively tested, is available now, and can be put to use immediately.

The International Process

The Vienna Convention for the Protection of the Ozone Layer, signed in March 1985, provides a framework for international cooperation in research, monitoring, and information exchange. The Montreal Protocol on Substances That Deplete the Ozone Layer, signed in September 1987, requires a 50 percent reduction in the production and consumption of CFCs by 1998, and freezes production of halons.

As amended at the end of last month in London, the Protocol now requires elimination of CFCs, halons, and carbon tetrachloride by 2000. There is a declaration of intent to phase-out HCFCs by 2040 and, if possible, no later than 2020. For methyl chloroform, the Protocol now provides the following schedule:

1993	--	Freeze at 1989 levels
1995	--	30 percent reduction from 1989 levels
2000	--	70 percent reduction from 1989 levels
2005	--	Complete phase-out

The Parties agreed in London to conduct a further assessment in 1992 to determine whether earlier phase-out dates for the various controlled substances would be achievable.

The most important objective now facing the Parties is obtaining worldwide acceptance of the stringent control measures agreed in the Montreal Protocol. Currently, fewer than half of the nations of the world have signed the Protocol. Participation by the nations that have not yet signed the Protocol is critical to achieving a substantial reduction in atmospheric chlorine.

Technology Transfer

The Parties agreed in London to establish a fund to provide financial assistance to developing nations that have signed the Protocol. The fund will serve to assist these nations in identifying how substances with ozone depleting potential are used in their domestic economies, developing alternatives, and implementing technologies that reduce emissions to the environment. The fund is expected to total betwen $150 and $240 million for the next three years.

In the short term, HSIA believes that assistance to developing nations should be directed toward using controlled substances more efficiently and in an environmentally sound way. Fugitive emissions from manufacture and use operations are generally higher in developing nations, due to the use of less efficient equipment and less careful operating procedures in some cases. Relatively simple measures such as use of covers on degreasing equipment and maintenance of greater freeboard height can significantly reduce emissions of substances such as methyl chloroform and CFC-113.

The producers of methyl chloroform are undertaking efforts that will lead to conservation of methyl chloroform in dispersive applications around the world. These include product and environmental stewardship programs, joint efforts to encourage safe use and disposal, and interaction with EPA and other U.S. and foreign regulatory authorities to develop better work practices, encourage use of better control technology, and, if appropriate, identify areas where more stringent controls should be required. HSIA members are committed to the economic and cost-effective use of methyl chloroform. Indeed, HSIA has compiled materials on solvent stewardship and circulated them throughout the industry. These materials are available from HSIA upon request.

A central component of these efforts is the Center for Emissions Control, which HSIA is initiating in cooperation with EPA. The Center for Emissions Control is being established to collect and distribute information on emissions control technology for the many applications of halogenated solvents, as well as information on alternative substances and technologies where they exist. This is a difficult task, as emissions control and the availability of alternatives depend on specific technical and economic factors that may differ greatly from application to application.

Among the projects being considered for the Center are the following:

- Broad commercial application of a solvent recovery system that eliminates the use of steam, thus avoiding solvent decomposition and acid formation (with the U.S. Department of Energy)
- Sponsorship of emissions control technology seminars for solvent-using industries
- Involvement in technology-transfer seminars and tours for government and industry representatives of developing nations.

The net result of these stewardship and conservation programs and the dissemination of control information will be a reduction in emissions of methyl chloroform. In the short term, however, use of methyl chloroform is a bridge technology to reduce emissions of CFCs. For example, one of the most difficult CFCs to replace is CFC-113, which, like methyl chloroform, is often used in cleaning electrical and computer components. While other materials and processes are also available for some of these applications, many important products still must be cleaned using methyl chloroform or CFC-113. In such cases, using methyl chloroform instead of CFC-113 results in an immediate four- to seven-fold reduction in potential ozone depletion.

Importance of Methyl Chloroform

Methyl chloroform is used widely in the electronics, aerospace, automotive, defense, medical products, aerosol, coating, textile, and adhesive industries. It has become the solvent of choice in these applications in the United States, Europe, Japan, and elsewhere because:

- It is virtually nonflammable and noncombustible,
- It is relatively nontoxic, and
- It is not photochemically reactive and does not contribute to the production of ozone (smog) in the lower atmosphere.

Set forth below by industry sector is a description of some of the more important applications.

Electronics -- Major electronics and aerospace companies depend on methyl chloroform to clean millions of high-technology printed circuit boards safely. These circuit boards are used in critical aerospace and defense applications including communications, weather, and military satellites, inertial guidance gyroscopes for aircraft and satellite guidance systems, ballistic and tactical missile guidance systems, and radar detection systems.

Methyl chloroform is important to the production of printed circuit boards in the manufacture of medical, business, and consumer electronics such as computer disc memory storage components, personal and mainframe computers, calculators, telefax machines, televisions, telephones, and stereos.

Methyl chloroform is critical in the automotive industry for cleaning (defluxing) hybrid circuits, particularly ceramic substrate electronics (i.e., ignition modules, engine controllers, fuel sensors, and voltage regulators).

Methyl chloroform is used in the manufacture and maintenance of electric and mechanical instrumentation of nuclear, hydroelectric, and chemical plants. This instrumenttation is crucial to the safe and efficient operation of these plants.

Precision Metal Cleaning -- Methyl chloroform is used where high performance cleaning is essential to prepare surfaces for subsequent assembly. Clean surfaces are necessary when parts need to be joined securely without slippage or creep that could lead to failure of products in use. Clean surfaces are necessary also to permit application of protective coatings.

The aerospace industry is particularly dependent on the use of methyl chloroform because of its heavy reliance on aluminum, which can not be easily cleaned with aqueous/alkaline systems. Methyl chloroform is essential to clean the space shuttle booster casings used to launch the NASA space shuttles. Methyl chloroform is essential also in the production of aircraft sheet-metal assemblies, and the non-destructive detection of fatigue cracks in commercial and military aircraft wings.

Methyl chloroform is used in the production of a wide variety of plastic and metal parts for the automotive industry. It is critical in the installation and safe operation of automotive and aircraft braking systems. Methyl chloroform is essential to clean the ends of wire rope used in bridges, on cranes, and to catch jets landing on aircraft carriers. In this latter application, reliability is crucial to preventing a multimillion dollar aircraft from being dropped into the ocean, quite possibly with loss of life.

Medical -- Methyl chloroform is the only compound approved by the Food and Drug Administration for the purification of hollow fibers used to provide oxygen to the blood during open-heart and kidney surgery. Methyl chloroform also is used in the production of syringes, cardiac pacemakers, and artificial joints, limbs, and implants. Its chemical properties allow it to penetrate the small openings in these products, and allow for the production of clean and dry surfaces essential to product reliability.

Coatings -- Coatings and ink manufacturers and users have found methyl chloroform to be the only viable solvent to allow them to comply with strict local (e.g., southern California) smog control regulations. Methyl chloroform is important in formulations of fast-drying paints used for traffic markings.

Adhesives -- Methyl chloroform is essential in the formulation of nonflammable adhesives. Flammable adhesives impose significant fire hazards to life and property in industrial and consumer applications. Use of methyl chloroform-based adhesives allows companies to comply with smog control regulations, and to avoid the excessively high product liability premiums associated with flammable products.

Aerosols -- Methyl chloroform is present in aerosol insecticides to reduce or eliminate flammability. It is a preferred solvent in wasp spray applications due to its instant knockdown ability, low toxicity, and safety of use. For those unfortunate individuals who may be allergic to the sting of a wasp, this product is literally life-saving.

Textiles -- Methyl chloroform is used commonly in the textile industry to safely and effectively remove oils and other difficult stains from cloth in the production of broadcloth, apparels, and other textiles.

A recent study to estimate jobs and product at U.S. companies using methyl chloroform found that over 73,000 manufacturing establishments rely on it.[1] These establishments employ over 3,000,000 production workers, or 23.5 percent of all U.S. manufacturing production employees. In 1988, these firms accounted for $295 billion of value added, or 25.1 percent of total gross manufacturing product.

The Quick, Finan & Associates study is based on establishment, employment, and output statistics compiled by the U.S. Bureau of Census, with usage factors supplied by marketing, technical service, and environmental experts in the industrial uses of methyl chloroform. It shows the pervasiveness of methyl chloroform throughout manufacturing industries, where the percentage of establishments using methyl chloroform ranges from a low of five percent in textiles and plastics manufacturing to over 55 percent in electronics, automobiles, and other transportation equipment manufacturers. The importance of methyl chloroform varies from state to state, depending on each state's industry mix and varying state environmental regulations and industrial practices.

Without methyl chloroform, some small businesses might shut down completely or drop certain products, because they have no suitable substitues or because it is too costly to redesign and retrofit their production processes. Other businesses would be

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1/ Quick, Finan & Associates, Jobs and Product at U.S. Companies Using Methyl Chloroform (1989), included as Exhibit I. The study includes estimates of manufacturing jobs in and value added by firms using methyl chloroform in each of the fifty states.

forced to risk reduced quality of output -- a key competitive factor, especially in high-technology industries. Virtually all would face higher costs and deterioration of international competitiveness as they undergo expensive redesign and/or shift to higher-cost replacements for methyl chloroform, where replacements are available at all. Moreover, many of the alternatives to methyl chloroform contribute directly to ground-level ozone formation, and therefore may not be used in many parts of the United States where smog is a serious health problem. Restricting use of methyl chloroform beyond the stringent requirements in the Protocol would make it more difficult to achieve the nonattainment provisions of the Clean Air bills now under consideration.

Adverse Effect of Unilateral Congressional Action

The Montreal Protocol and the successful efforts to strengthen it have been widely recognized as the appropriate response to the global environmental concern over stratospheric ozone depletion. The expanded Protocol will become part of U.S. law upon ratification. There is no reason for the U.S. Congress to be considering unnecessary legislation that at best would duplicate the expanded Montreal Protocol, and at worst could hinder the ability of the United States to phase out CFC use and subject U.S. companies to production controls and regulations more stringent than those imposed on companies operating in other nations. Unfortunately, both the Senate and the House versions of the revised Clean Air Act that will be going to conference contain control schedules for methyl chloroform and other substances that differ significantly from the schedules in the amended Protocol.

Unilateral action by Congress to control CFCs, halons, and other potential ozone depleting chemicals would put U.S. industry at a competitive disadvantage compared to foreign companies that would be under less stringent restrictions. The effects of such unilateral action on methyl chloroform and the HCFCs would be particularly pronounced, as U.S. companies in the electronics and aerospace industries, among others, would be deprived of products that their foreign competitors would be using in place of CFCs in many applications. This could lead to the export of jobs from the United States, as, for example, firms move operations involving electronic assembly offshore.

It is entirely unrealistic to expect U.S. manufacturing industry to develop new technologies without the same transitional phase during which substances with low ozone depletion potential would be available. Moreover, the statospheric ozone titles of the House and Senate Clean Air bills go further than simply modifying the control schedules in the Montreal Protocol. One or the other of these bills would prohibit use of methyl chloroform or HCFCs in aerosol and plastic foam products (other than foam insulation products) after 1994. Aerosol packagers and foam producers have increasingly relied upon methyl chloroform as a nonflammable, relatively nontoxic substance that does not contribute to smog formation. Foreign producers of these products will be free to continue to use methyl chloroform and HCFCs in these products after 1994.

The Clean Air bills contain other provisions dealing with consumer products and labeling that would penalize U.S. users of methyl chloroform and HCFCs without producing any environmental benefit. For example, methyl chloroform could no longer be used in making an undefined class of "nonessential products" under the House bill, even though foreign companies would be under no similar restriction under the Protocol.

Provisions such as the ones described above are unlikely to have any effect on the overall production of methyl chloroform, as the freeze and reduction schedule under the Protocol results in a restriction of supply. They would, however, replace the free market with a bureaucratic framework that does not exist in other countries.

Trade sanction measures are not an adequate answer to the dilemma that these bills would impose on U.S. manufacturing industry. Due to the large number of products manufactured using methyl chloroform and the other controlled substances, trade barriers are impractical. Under the Agreement on Technical Barriers to Trade ("Standards Code") of the General Agreement on Tariffs and Trade (GATT), the United States may not as a general rule impose standards that create unnecessary obstacles to international trade.

Although it would impose significant costs on U.S. society, revision of the Clean Air Act to go beyond the measures agreed in the Protocol would achieve no significant environmental benefit. As recognized in a recent article in Nature published by two leading scientists with the National Aeronautics and Space Administration (NASA), continued used of methyl chloroform at current levels well into the next century would cause little change in the time required to reach a stratospheric chlorine level of 2 parts per billion (ppb), the estimated concentration at which the Antarctic ozone hole was first observed.2/ The NASA scientists concluded that "the critical factor determining the 2-[ppb] date is the timing of the phase-out of the long-lived halocarbons (CFCs and [carbon tetrachloride]), not the short-lived halocarbons ([methyl chloroform] and HCFC-22)."3/

Now that the Protocol has been revised to include a stringent control schedule resulting in total elimination of methyl chloroform production in just 15 years, it cannot seriously be argued that a more rapid phase-down is necessary to save the environment. Indeed, more restrictive measures to control methyl chloroform and the HCFCs could be counterproductive to international efforts to eliminate CFC use as rapidly as possible, if it turns out that other alternatives to CFCs are not developed as rapidly as projected.

2/ Prather, M.J. and Watson, R.T., Stratospheric Ozone Depletion and Future Levels of Atmospheric Chlorine and Bromine, 344 Nature 729 (Apr. 19, 1990).

3/ *Id.* at 732.

Mr. **Scheuer**. Thank you, Mr. Cammer.

This is an extremely interesting panel. I would like first to ask a question that was submitted to us by Congressman Ralph Hall's staff.

This is an exceptionally interesting panel. I would like at this point to thank both Congressman Ralph Hall, and his excellent, very professional staff, for their fine cooperation in preparing for this hearing. I am deeply disappointed that Congressman Hall was not here to chair it with me.

In any event, his staff has asked me to ask a question on his behalf.

Does the Montreal Protocol, in combination with the current provisions of the Clean Air Act, which is in conference now, provide sufficient regulatory stability for industry to commit the resources needed to development of new CFC substitutes? In other words, is there stability and incentives for industry to make the capital investment to develop CFC substitutes, any of them?

Mr. **Fay**. Mr. Chairman, I think I can answer that. I think the protocol provides very substantial incentives, both negative and positive, to develop substitutes. The Clean Air Act, on the other hand, presents some very troubling problems for us from the standpoint of the House Bill having a provision in there that would essentially put EPA in the position of being an industrial planning agency. It allows them, within two years, to start banning the substitute technologies.

Within two years to three years of the date of enactment of the bill, they can start putting bans on substitute technologies being developed. If you are trying to get an industry that has to invest on the order of $200 million to a billion dollars per company to invest in manufacturing some of these products, the threat of a ban two years from now or a regulatory action against them within two years makes no sense at all. So that's a very troubling section.

Mr. **Scheuer**. What would the rationale of that be?

Mr. **Fay**. I think there has been an overriding concern by some in the environmental community that the industry is putting too much of an investment in HCFC compounds. The industries recognize the HCFC compounds are transitional compounds. The industry has also announced that they will support a realistic phase-out date for these compounds. But we need them in order to phase out CFCs. The only way to get the industry to make the investments necessary to use HCFCs in the short-term is to provide some assurance that they will be able to use them.

Mr. **Scheuer**. And to get their capital back.

Mr. **Fay**. And to get their capital back. It's one thing to argue about whether a chemical company can get their capital back, but these compounds for the most part are not available today. The user industries will not be starting to use them, really, until after 1995. So the environmental communities wanted these things phased out in 2010, and all of a sudden, people on the finance committees of large corporations who have to make billion dollar investments are starting to wonder if they should go invest in something else.

We supported the U.S. support for a phase-out date on HCFCs at the international level. We do not think it is appropriate in the

Clean Air Act to unilaterally adopt such a phase-out date. It is going to be a very difficult bargaining issue in the Protocol in the coming years, and in the coming assessments. It is not appropriate for us to be adopting by law a fixed position that will have to be negotiated later with our global competitors.

And this is very much wound up in the European communities asking for a 1997 phase-out date on CFCs. That's a political argument, and an economic one for them. It seems very strange that all of a sudden, the European community has found such an environmental awareness when they could have banned aerosol uses 12 years ago. Now, all of a sudden, they want to ban CFCs. That 1997 ban on CFCs won't affect industry, because by 1997 all the industries in this country will not be using CFCs to make any new products.

The people it will hurt are the constituents in your districts, the constituent who owns a refrigerator, who owns an automobile, and the small business, the grocery store owner, who owns a refrigeration system in his grocery store. The only thing those CFCs will be used for between 1997 and the year 2000 is to supply existing, installed equipment of which we have the largest installed base in the world.

It is clearly an economic move on the Europeans' part to make them look good environmentally, and give them an economic advantage. They don't support HCFC phase-out. The reason we could not get an HCFC phase-out date in the Protocol is because the Europeans would not support it.

So it is silly for the Congress to turn around and adopt a unilateral phase-out date on HCFCs when it is wrapped up in so many other economic and environmental issues that we have to negotiate globally.

Mr. SCHEUER. Do you think we can best preserve our negotiating strength by playing by the same ground rules that our competitors in Europe are playing by, and then negotiating together?

Mr. FAY. Absolutely.

Mr. SCHEUER. So that there is no competitive disadvantage.

Mr. FAY. Absolutely. And history has proven that right. In 1978 we banned aerosol uses. Until now, aerosol uses are still the largest use of CFCs in the world.

Mr. SCHEUER. And the Europeans have not caught up with us?

Mr. FAY. They are just now getting around to banning their aerosol uses.

Mr. SCHEUER. What do you think is the pressure behind their doing that? Where does the incentive come from?

Mr. FAY. For banning their aerosol uses? The environmental movement has done a good job in Europe of getting their attention, their awareness. But U.S. industry in 1986 was the first industry group anywhere to announce their support for an international agreement to limit the use of these compounds. We made a very conscious decision in 1986 that the best way to solve this problem, both environmentally and economically, was at the international level. Unilateral regulations are only going to hurt our ability both to protect the environment and to protect U.S. jobs.

Mr. SCHEUER. But you do credit political activism and changing perceptions on the part of the public and an increasing demand on the part of the public that industry get its act together for the movement that is beginning, at least, to take place in Europe now.

Mr. FAY. Sure, I give them credit. I give the industry credit as well. When industry announced in 1986 that it was time to negotiate an international limitation on these compounds, that marked the beginning of the end of these compounds.

Mr. SCHEUER. Yes. And I think when Dupont announced about a year ago that they thought we ought to get out of the business of manufacturing these compounds, and we should not wait until the year 2000 to do it, we ought to do it now, I thought that was a tremendous act of industry statesmanship. It accelerated, did it not, the willingness of industry to tighten its belt and get on with it?

Mr. FAY. Well, the industry had to bite the bullet in 1986. Economically, in 1986 these compounds became dead chemicals. It is now up to us, in terms of a rational economic transition, to get out of them without causing harm to the hundreds of billions of dollars worth of equipment in this country that is owned by consumers and small business.

Mr. SCHEUER. Let me ask Liz Cook. Do you agree with Mr. Cammer's statement that U.S. regulation should more or less mirror the terms of the Montreal Protocol, and we should not get out ahead in unilateral commitments which are going to lessen our bargaining position at the conference table?

In other words, is there any advantage to the U.S. going above and beyond the Protocol, unilaterally?

Ms. COOK. There is clearly an environmental advantage. I don't believe it is political jockeying of European nations. I have documentation here from several national action plans of several countries that have much more stringent programs to protect the ozone layer than our Clean Air Act Amendment is currently considering.

Mr. SCHEUER. Well, now wait a minute. What do you say to that, Mr. Paul Cammer?

Mr. CAMMER. What do I say to which part of it?

Mr. SCHEUER. What do you say Ms. Liz Cook's proposition that we should go ahead unilaterally, and that there are European countries that are right up there with us with plans that exceed ours in the effectiveness with which they reduce these environmentally degrading chemicals?

Mr. CAMMER. Two points. One is that one of the things that was recognized during the two-week meeting in London last June was that while there was a lot of work done on the CFCs and the technology review panel, how soon they can be phased out, and while some work was done on methyl chloroform, it was considerably less, in that our knowledge about how to get out of methyl chloroform is much less than what it is for other compounds.

Consequently, what the UNEP parties decided was to ask the technology review panel to look at this question and try to do a much more thorough job than they had, clearly understanding that we do not have all the information now that we need to make an intelligent decision on this compound.

Secondly, different countries have different types of economies and different types of companies. In the United States, as I said, there were 73,000 to 75,000 companies that use significant amounts of methyl chloroform. There are a lot more companies that use somewhat lesser amounts of methyl chloroform. It is used in a great variety of ways, in little nooks and crannies of companies. Many of these companies themselves do not know that they are using it, and how important it is to them. I think we all need to study this before we just eliminate it from an industry that we don't know can tolerate such elimination.

Different countries have different needs, and different companies and different industries. If we don't make sure that we understand that before we have unilateral action in this country, or any country, we will be in trouble here.

Mr. **Fay**. Let me also address the point that has been raised by Ms. Cook. Fifty to 60 percent of the use of CFCs in Europe was for aerosols. They could meet the current Protocol of 50 percent reduction immediately just by banning their aerosol uses. They do not have the installed base or the reliance on air conditioning and refrigeration technology that we have.

Even in New York City, as you well know, it is kind of tough in the summers in New York City not to have an air conditioner in your apartment. It is tough down in Texas not to have an air conditioner in your car. But refrigeration technology and air conditioning technology have been at the forefront of a lot of the social and economic development in the United States in the last 30 years, in terms of development and growth in the Sun Belt, improvements in productivity, allowance for computer technology.

They (the Europeans) do not have the reliance on refrigeration equipment or the installed base of refrigeration equipment that we have. We have twice as high a percentage of refrigeration equipment than those countries.

And sure, some countries can move in a more accelerated fashion. But as I said, the issue of the 1997 phase-out date versus the 2000 phase-out date in the United States is the difference between $135 billion worth of existing installed equipment belonging to consumers and small businesses in this country becoming obsolete prematurely. All we are arguing for is that you have to have a transition period that allows that equipment to recognize its useful life.

That does not mean we will not develop some kind of a drop-in substitute that can be used in existing equipment. They do not exist yet. But we hope to be able to do that. They do not exist yet.

Ms. **Cook**. One quick response. I have a strong memory of being freezing at the London meeting because the air conditioning at the IMO was turned up so high. So I sincerely doubt that our European friends are not well-accustomed to air conditioning technology.

One broad generalization I would like to make about industry's response to the ozone depletion problem is that industry is consistently finding solutions and alternatives much faster than they ever thought was previously possible. I would like to quote the West German Environment Minister as he was quoted in the Washington Post. Let me say that West Germany is now committed to a 1995 phase-out of CFCs. He said "I am absolutely convinced that if you give a clear-cut timetable, it will stimulate industry to come up with substitutes. But if more time is allowed, I really believe it will take more time."

I don't believe it would put U.S. industry at an economic disadvantage to move more quickly. In fact, I think if we move more quickly, we will develop technologies and be competitive with other European countries that are already domestically committed to moving faster.

Mr. **Scheuer**. There is considerable evidence that what you say is true. In the history of Clean Air regulation, tailpipe emissions, when Congress sets standards, the automobile industry always, almost always, and almost unanimously says they cannot possibly meet those standards. And in that event they met those standards very successfully, very happily. They have always underestimated their own mechanical, engineering and technology genius that really resides in that industry.

Mr. **Fay**. Let me interject one point here. I agree—

Mr. **Scheuer**. I really want to yield to—

Mr. **Fay**. I think we in many respects always end up being our own worst enemies, and that we look at something, think it will take this long, and perhaps we end up doing it sooner. The auto analysis has been used on this issue before, but it is not the same. No one required anybody to go back and retrofit all the existing cars on the road with catalytic converters. But nobody was trying to ban those cars, and a lot of those cars are still on the road today, some of those old cars. So it is not a situation where they—

Mr. **Scheuer**. If you want to make such a suggestion, I am a conferee on the Clean Air Act.

Mr. **Fay**. Actually, it might help car sales, which are down a little bit.

But industry is developing the new technologies. That is happening. That is happening, and it is happening at a very rapid pace. By the middle of the decade, we hope not to be manufacturing any products relying on the current compounds. But the issue is the transition for the existing compound.

Mr. **Scheuer**. Okay. Congressman Ron Packard?

Mr. **Packard**. Thank you, Mr. Chairman. Ms. Cook, I know that in your testimony you expressed your deep concern and your primary concern about the length of implementation. You felt it could be shorter. Does it give you any comfort that they did include a reevaluation in 1992?

Ms. **Cook**. Absolutely. And we look forward to the U.S. EPA participating actively in the reevaluation of how quickly we can phase out methyl chloroform, because they have already done one analysis that indicates it could be done by the end of the century, and there is some controversy over that.

But we are very pleased that it will be examined quickly.

Mr. **Packard**. Mr. Fay, has the chemical industry in this country received, or have you looked for, input from the Federal R&D community? Are there efforts underway for the Federal labs that they might aid in developing the technology for substitutes?

Mr. **Fay**. There are some cooperative efforts in terms of the research. Frankly, we would rather see, I think, rather see the Government spend its research dollars, which are scarce, on the scientific analysis and the effects research for the Antarctic ozone hole and areas such as that.

Industry is quite willing to do the research, and bear the burden of producing the technologies. Unfortunately, it is a little different situation than what you find in a country like Japan. In Japan, the

Government is actually funding some of the basic research. They have already started a program to fund the research into third generation technologies. They are funding research with the electronics industry for new solvents.

While we are not asking for research dollars, we are working with the Government research agencies on that, and identifying areas, for example, in the refrigeration area, to identify research on materials compatibility and things of that nature. What is hurting us instead—and we get the opposite of Japan, where Japan's government is giving money to the industry to do research, our Government turned around and put a $5 billion excise tax on our industries.

So the frustration for U.S. industry is that we have said since 1986, we can solve this problem, just give us some room. Give us the goal, give us the deadline, and we will do it. But in the meantime, we are being used as a deficit reduction program, and $5 billion in excise taxes in an industry where the chemical sales annually are $600 million, is a hell of a lot of money.

And while people are arguing that that is the economics of the limitation on the compounds, that capital is getting siphoned right out of the industries, and the consumers that rely on the compound.

Mr. PACKARD. Mr. Cammer, there are two substitutes which are halogenated solvents that were added to the Protocol. Was your industry involved in that and advised? And were you fully aware of that? Did they call for input from the industry?

Mr. CAMMER. Yes, and we worked with EPA and other agencies on this, and HSIA has agreed and believes that these chemicals should be added to the Protocol. We are in favor of phasing out carbon tetrachloride by the year 2000, along with CFCs, and methyl chloroform is going to be phased out by 2005.

Mr. PACKARD. How far along are we on replacement technology?

Mr. CAMMER. I think we have a long way to go. On replacement technology for carbon tetrachloride, the use in this country has been declining drastically, while some countries in other parts of the world have been using it for a cleaning solvent. Instead, this country has moved to much less toxic compounds, such as methyl chloroform. Now, when you ask the American Electronics Association or the aerospace industry whether they think they can get out of methyl chloroform in a short time, they say the best they can do is maybe 40 percent by the year 2000.

Well, now, the goal is going to be 70 percent by the year 2000, and I think it will be very difficult to meet, and there will be some economic impacts. What we need to do is work very hard with industry and with Government to make sure that we minimize those economic impacts.

Mr. PACKARD. But at this point we do not have any replacement solvents that are based on water or on more natural products?

Mr. CAMMER. No, that's not correct. The problem with methyl chloroform is that it is used in such a variety of industries, and in such a variety of companies that no single replacement for methyl chloroform is available. Indeed, there are aqueous-based products that can replace methyl chloroform now, and many companies are moving in that direction. It depends on how they are using methyl chloroform, what type of product they are cleaning, how clean it needs to be, etc., whether they can do that now, five years from now, or whether they will just not be able to do it at all.

We have been told by at least one major company in this country that once methyl chloroform is gone, their particular product line that uses that compound will also be gone, because not only do they not have a substitute, but they do not foresee such a substitute.

Mr. **Packard**. Are foreign countries using the methyl chloroform?

Mr. **Cammer**. Oh, yes. It is used primarily in heavily industrialized countries, Western Europe, Japan—

Mr. **Packard**. Are they producing their products themselves, or do they import most of it?

Mr. **Cammer**. It depends on which product you are talking about.

Mr. **Packard**. Methyl chloroform.

Mr. **Cammer**. Methyl chloroform is produced in Japan, in Western Europe, and I believe there is a plant in Brazil.

Mr. **Packard**. So, there is not a heavy dependence on us or other developed countries for their supply of methyl chloroform?

Mr. **Cammer**. Not at this point in time. It may change, of course, if the production in this country is limited beyond what the production would be required by UNEP.

Mr. **Packard**. Thank you, Mr. Chairman, that's all.

Mr. **Scheuer**. Just one more question. Mr. Fay, you talked about drop-ins for refrigeration not being developed yet. There is a New York Times article of June 23 that says that Dupont is building four new plants to reduce HFCs, and that "When the plants become operational between 1992 and 1995, they will have the capacity to produce 140 million pounds of refrigerants annually, enough to supply most world- wide refrigeration needs through the end of the century."

Are these HFCs drop-ins or are they not drop-ins?

Mr. **Fay**. No. They are not drop-ins for existing equipment. They have materials compatibility problems, lubrication problems. From what we understand, I think what they mean by that statement is that they can supply the needs for new equipment, but they cannot supply the needs for existing equipment.

There is work underway on some blends using some HCFCs, using HCFC22 and some of the compounds that are still underway. In fact, there have been announcements in the last year of so about the potential for blends. But many of the compounds that are part of the blends are still going through the toxicological testing process at EPA, which are still two to three years away from completion.

So it is not clear that drop-ins for the existing equipment will become available. There is a great deal of hope on the part of a lot of people, but there is also a great deal of focus on getting at least the chemicals done that can be used in new equipment as an important first step.

Mr. **Scheuer**. All right. I want to thank the panel for a very excellent hearing. The hearing is adjourned.

[Whereupon, at 11:54 a.m., the subcommittees were adjourned, to reconvene at the call of their respective Chairs.]

APPENDIX

OCT 4 1990

United States Department of State

Washington, D.C. 20520

September 27, 1990

Dear Mr. Chairman:

Following the hearing on July 24, 1990 at which Mr. Richard J. Smith testified, additional questions were submitted for the record.

Please find enclosed responses to those questions.

Sincerely,

Janet G. Mullins

Janet G. Mullins
Assistant Secretary
Legislative Affairs

Enclosures:
As stated.

The Honorable
James H. Scheuer, Chairman,
Subcommittee on Natural Resources, Agriculture
Research and Environment
Committee on Science Space, and Technology
House of Representatives.

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Subcommittee on Natural Resources, Agriculture
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Committee on Science Space, and Technology
House of Representatives.

Q: Since the Second Meeting of the Parties to the Montreal Protocol, have India and China joined the Protocol as was indicated by their delegations? Have additional developing countries indicated a willingness to become parties to the Protocol since the London meeting?

A: NEITHER INDIA NOR CHINA HAVE BECOME PARTIES TO THE PROTOCOL SINCE THE JUNE MEETING IN LONDON. HOWEVER, SINCE THAT TIME, BANGLADESH, GAMBIA, LIBYA AND POLAND HAVE JOINED THE PROTOCOL.

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Nairobi, Kenya

Your Reference

Our Reference MP/2105-89-03

9 August 1990

Sir,

I have the honour to submit to you the report of the Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer (UNEP/OzL.Pro.2/3.) The Second Meeting of the Parties was held in London, 27-29 June 1990 at the kind invitation of the Government of United Kingdom.

I am pleased to inform you that I have submitted the adjustments and the Amendment of the Montreal Protocol, which the Meeting so successfully developed and adopted by consensus, to the Depository for circulation as soon as possible.

The adjustments will in accordance with Article 2, paragraph 9 of the Montreal Protocol, enter into force six months after they have been circulated by the Depository to all Parties.

The Amendment shall enter into force on 1 January 1992, provided that at least twenty instruments of ratification, acceptance or approval of the Amendment have been deposited by States or regional economic integration organizations that are Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer. In the event that this condition has not been fulfilled by that date, the Amendment shall enter into force on the ninetieth day following the date on which it has been fulfilled.

His Excellency
The Secretary of State
c/o The Permanent Mission of the
United States of America to UNEP
P.O. Box 30137
Nairobi
Kenya

For the purposes of the above, any such instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of such organization.

After the entry into force of the Amendment, it shall enter into force for any other Party to the Protocol on the ninetieth day following the date of deposit of its instrument of ratification, acceptance or approval.

I am pleased to draw to your attention that the Government of Canada, as the first Party, has deposited its instrument of acceptance of the Amendment, and that the representatives of China and India indicated at the Meeting of the Parties that they would recommend to their Governments to accede to the amended Montreal Protocol.

Furthermore, I would like to draw to your attention the decisions made by the Parties as contained in the report of the meeting, chapter IV, Decisions, especially Decision II/8. Financial Mechanism, which implements, for an interim period of three years beginning on 1 January 1991 the amended of article 10 of the Protocol. The mechanism includes a Multilateral fund and other multilateral, bilateral and regional cooperation. For the purpose of implementing the interim Multilateral Fund of US$160 million the Parties adopted an indicative list of categories of incremental costs that would be covered by the Fund if and when these costs are incurred by developing countries operating under paragraph 1 of article 5; terms of reference for the Multilateral Fund; terms of reference for the Executive Committee of the Parties which will control and administer the Fund; and the percentages of contribution to be made towards the Fund by the developed coutries that are Parties to the Protocol. All these are contained in Annex IV of the report.

I would also like you to note the declaration in chapter VI of the report by 13 countries to phase-out the production and consumption of all fully halogenated chlorofluorocarbons controlled by the Protocol as adjusted and amended, as soon as possible but not later than 1997.

Finally, I would like to also draw to your attention that the 95 Governments and the European Communities represented at the Second Meeting of the Parties to the Montreal Protocol adopted a resolution regarding the use of other halons not controlled by the Protocol and the use of transitional substances, such as hydrochlorofluorocarbons (HCF's). The resolution is contained in Annex VII to the report.

Accept, sir, the assurances of my highest consideration.

M. K. Tolba

Mostafa K. Tolba
Executive Director

EP

United Nations
Environment
Programme

Distr.
GENERAL

UNEP/OzL.Pro.2/3
29 June 1990

ORIGINAL: ENGLISH

SECOND MEETING OF THE PARTIES TO THE
MONTREAL PROTOCOL ON SUBSTANCES
THAT DEPLETE THE OZONE LAYER

London, 27-29 June 1990
Agenda item 7

REPORT OF THE SECOND MEETING OF THE PARTIES TO THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

INTRODUCTION

1. The Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer was held at the headquarters of the International Maritime Organization, in London, from 27 to 29 June 1990, at the invitation of the Government of the United Kingdom of Great Britain and Northern Ireland.

I. OPENING OF THE MEETING

A. Opening remarks by the President of the Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer

2. His Excellency Mr. K. Bärlund, Minister of the Environment of Finland and President of the First Meeting of the Parties, declared the meeting open at 10 a.m. on Wednesday, 27 June 1990. He observed that real progress had been made in under three years: agreement had been reached on the Protocol in 1987; it entered into force early in 1989; and political agreement to strengthen the Protocol had been reached soon thereafter at the First Meeting of the Parties, held in Helsinki. A major task facing the Parties was to make financial resources and technology available to developing countries so that they could participate effectively in the international effort that was required.

B. Welcoming remarks by the Secretary-General of the International Maritime Organization

3. Mr. W. O'Neil, Secretary-General of the International Maritime Organization (IMO), welcomed participants to IMO headquarters. As an organization concerned with the marine environment, as well as the operation of ships, IMO recognized that CFCs and halons on board ship caused pollution. Yet, they played an essential role in ensuring safety at sea. There was, therefore, a clear need for changes to be devised and put into effect.

C. Statement by the Prime Minister of the Government of the United Kingdom

4. The Prime Minister of the Government of the United Kingdom, the Right Honourable Mrs. Margaret Thatcher, stated that there was increasing scientific evidence of the damage caused to the ozone layer by CFCs and other chemicals. However, over the previous 15 months there had been encouraging signs of success in convincing the public of the gravity of the situation, as was shown by increased purchases of ozone-friendly products. The United Kingdom had called for a European Community initiative on labelling of products to reinforce that trend by providing honest information. Manufacturers were also constantly developing substitute technologies. It was now for Governments to build on the historic achievement of the Montreal Protocol and draw up a global convention on climate change, which ought to be ready by 1992, in time for the United Nations Conference on Environment and Development.

5. In view of the damage that had already been done to the ozone layer, the targets previously set in the Protocol were not ambitious enough. Higher targets and shorter deadlines must be set for reducing and eliminating CFCs and halons, and the scope of the Protocol must be extended to cover other substances such as carbon tetrachloride and methyl chloroform. The search for safe alternatives must be intensified, which was no easy task. British industry was making some notable contributions.

6. The controls in the Protocol could achieve successful results only if all countries, including those from the third world, were signatories. But countries at any early stage of industrial development had understandable concerns about adverse effects on their economic growth. It was the duty of industrialized countries to help them with substitute technologies and with financing the additional costs involved. Britain supported the proposal for an initial three-year programme of action and was ready to contribute at least $9 million to it, rising to $15 million if other major consumers joined the Protocol.

D. Statement by the Executive Director of UNEP and presentation of a Global 500 Award to the Prime Minister of the Government of the United Kingdom

7. Dr. Tolba, the Executive Director of the United Nations Environment Programme (UNEP), expressed his gratitude to the Prime Minister and the Government of the United Kingdom for hosting the meeting, as well as his appreciation to the Secretary-General and staff of IMO for their contribution to its smooth organization. Noting the progress that had been made since the London "Saving the Ozone Layer" Conference had been held 15 months

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previously, he said that the groundwork for a successful conclusion of the meeting had been laid through the efforts of the Open-Ended Working Group of the Parties, which had met immediately prior to the current meeting. Difficulties, of course, remained but, in view of what was at stake, there was general agreement that failure could not be contemplated. Indeed, the importance of the meeting went beyond the issues immediately before it: a successful outcome would give rise to greater confidence in tackling the other, much more complex, environmental issues that loomed and would contribute to the establishment of a new political movement to deal with the environmental crisis, based on long-term benefit for all, and rooted in respect for the value of human life and for nature.

8. Finally, praising the United Kingdom Prime Minister for championing the cause of the ozone layer and for her statesmanship on other environmental issues, the Executive Director presented her with a Global 500 Award in recognition of her outstanding work in putting the environment at the top of the international agenda and thus providing an example to many throughout the world.

II. ORGANIZATIONAL MATTERS

A. Attendance

9. The following 54 Parties to the Montreal Protocol were represented: Australia, Austria, Belgium, Brazil, Byelorussian SSR, Cameroon, Canada, Chile, Denmark, Egypt, European Economic Community, Finland, France, German Democratic Republic, Federal Republic of Germany, Ghana, Greece, Guatemala, Hungary, Iceland, Ireland, Italy, Japan, Jordan, Kenya, Liechtenstein, Luxembourg, Malaysia, Maldives, Malta, Mexico, Netherlands, New Zealand, Nigeria, Norway, Panama, Portugal, Singapore, South Africa, Spain, Sri Lanka, Sweden, Switzerland, Syrian Arab Republic, Thailand, Trinidad and Tobago, Tunisia, Uganda, Ukrainian SSR, Union of Soviet Socialist Republics, United Kingdom, United States of America, Venezuela and Zambia.

10. The following 42 States not party to the Protocol were also represented: Algeria, Angola, Antigua and Barbuda, Argentina, Bangladesh, Barbados, Botswana, Brunei Darussalam, Bulgaria, Burundi, China, Colombia, Congo, Côte d'Ivoire, Czechoslovakia, Dominica, Ecuador, El Salvador, India, Kuwait, Malawi, Morocco, Myanmar, Paraguay, Peru, Philippines, Poland, Qatar, Republic of Korea, Romania, Saudi Arabia, Senegal, Somalia, Sudan, Swaziland, Togo, Turkey, Uruguay, Yemen, Yugoslavia, Zaire and Zimbabwe.

11. Observers from the following United Nations bodies and specialized agencies were also present: United Nations Office of Legal Affairs, United Nations Conference on Environment and Development, United Nations Development Programme (UNDP), International Maritime Organization (IMO), United Nations Industrial Development Organization (UNIDO), World Bank and the World Meteorological Organization (WMO).

12. The following other organizations were represented: AFCAM - Australia, Air Conditioning and Refrigeration Institute, Alliance for Responsible CFC Policy, Ashrae, Australian Conservation Foundation, Brazilian Association of Electrical and Electronic Industries (ABINEE), Chemical Association (Austria), CIFL (United States), Consumers' Association (United Kingdom), Conference of

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European Churches, Du Pont International SA, Environment and Energy Study Institute, Environmental Resources Ltd., European Council of Chemical Manufacturers' Federations (CEFIC), European Free Trade Association (EFTA), Exploration and Production Forum, Federation of European Aerosol Associations (FEA), Friends of the Earth International, Greenpeace International, Halogenated Solvents Industry Alliance, ICOLS, Industrial Technology Research Institute (ITRI), Institute for Cultural Affairs, Institute for Studies in Environmental Law (ISEL), International Chamber of Commerce (ICC), International Council of Environmental Law, International Institute for Environment and Development (IIED), International Institute of Refrigeration, Japan Association for Hygiene of Chlorinated Solvents (JAHCS), Japan Electrical Manufacturers Association (JEMA), Japan Flon Gas Association, Motor Vehicle Manufacturers Association (United States) (MVMA), Natural Resources Defense Council, Pharmaceutical Aerosol CFC Coalition, Program for Alternative Fluorocarbon Toxicity Testing (PAFT), Refrigeration Industry Board (RIB), Société ECIA, SRF Ltd. (formerly Shri Ram Fibres), Stockholm Environment Institute, Ulsan Chemical Co. Ltd., Worldwatch, World Wide Fund for Nature International (WWF) and Ziegler and Associates.

B. Election of officers

13. In accordance with rule 21, paragraph 1, of the rules of procedure, the following officers were elected, by acclamation, at the opening meeting:

President:	Rt. Hon. Chris Patten, Secretary of State for the Environment, United Kingdom
Vice-Presidents:	Mr. Paulo Tarso Flecha de Lima, Ambassador of Brazil to the United Kingdom
	Mr. Philip Woolaston, Minister of Conservation, New Zealand
	Prof. Vladimir Zakharov, Deputy Chairman of the USSR State Committee for Hydrometeorology
Rapporteur:	Mr. Paul Malukutila, Minister of Water, Lands and Natural Resources, Zambia

C. Adoption of the agenda

14. The following agenda, as contained in document UNEP/OzL.Pro.2/1/Rev.4, was adopted:

1. Opening of the meeting:

(a) Opening remarks by the President of the Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer;

(b) Welcoming remarks by the Secretary-General of the International Maritime Organization;

(c) Statement by the Prime Minister of the Government of the United Kingdom, the Right Honourable Mrs. Margaret Thatcher;

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(d) Statement by the Executive Director of UNEP.

2. Organizational matters:

(a) Election of the President, three Vice-Presidents and the Rapporteur;

(b) Adoption of the agenda;

(c) Credentials of representatives.

3. Consideration of the reports and notes of the Secretariat:

(a) Introduction by the Executive Director;

(b) Statement by the Secretary-General of the World Meteorological Organization;

(c) Brief presentation of the latest developments in science regarding the ozone layer;

(d) Reports and notes on:

(i) Implementation of the Protocol:

a. Report of the Executive Director;

b. Assessment panels and updating assessment reports;

c. Workplans pursuant to Article 10;

d. Reporting of data and information;

(ii) Procedures and institutional mechanisms for non-compliance;

(iii) Adjustments and amendments to the Protocol.

4. Other decisions of the Parties.

5. Consideration of the proposed budgets and proposed percentages and amounts of contributions by Parties.

6. Other matters.

7. Adoption of the report.

8. Closure of the meeting.

D. Credentials

15. In accordance with rule 19 of the rules of procedure, the officers of the Meeting examined the credentials of representatives and, having found them to be in good and due form, so reported to the Meeting.

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III. SUBSTANTIVE MATTERS

A. Introduction by the Executive Director

16. In his introductory statement, the Executive Director of UNEP, stressing the historic importance of the meeting and the remarkable progress achieved since the entry into force of the Montreal Protocol, said that industrial, scientific and governmental committees had accepted that the initial target of freezing CFC production and halving output would not save the ozone layer. Even if production of all ozone-depleting chemicals was stopped immediately, it would take 80 years to plug the ozone hole over Antarctica. CFCs were also major contributors to the greenhouse effect The Bureau and the Open-Ended Working Group of the Parties had hammered out the proposed agreement currently before the Parties, an agreement that would pave the way for meaningful action by Governments. In terms of the provisions of a strengthened Protocol, UNEP endorsed the phasing-out by the year 2000, and preferably earlier, of the five CFCs and three halons currently controlled and of all other fully halogenated CFCs; the elimination of the use of carbon tetrachloride and a considerable reduction in the use of methyl chloroform by the same date; and the inclusion of all substitutes on a separate list with a requirement for annual reports on their production and consumption, strict guidelines for their use and a commitment to phase them out within a specified period, together with a clear indication to industry that what was required were substitutes with no ozone-depleting or global-warming potential. The issue of possible new halons should also be addressed.

17. Since the current 60 Parties to the Protocol were responsible for over 90 per cent of the production and consumption of ozone-depleting chemicals, the inclusion of those three elements would provide the basis for a meaningful instrument.

18. The Protocol must also be forward-looking. One hundred States Members of the United Nations had still to become Parties, among them, newly industrializing nations, two of which, in particular, represented over one third of mankind. Such nations required incentives to leap-frog the CFC phase in their industrial development and unless full agreement was reached on such incentives, there could be no meaningful Protocol. He was much encouraged by the fact that Parties were now ready to make provision for those incentives in the form of a financial mechanism and technology transfer. The Open-Ended Working Group had agreed upon target funding and a scheme for contribution to a properly financed multilateral fund designed to meet the incremental costs to developing countries of complying with the current and proposed strengthened provisions of the Protocol. The Meeting also had before it his proposal for technology transfer, which was the outcome of the fullest consultations between Governments and industry.

19. The Parties therefore had before them the essential constituents of what UNEP considered to be a meaningful agreement. Stressing that far more than the ozone layer was at stake, he said that a successful outcome would give a tremendous boost to the forthcoming World Climate Conference and provide an impetus for the conclusion of conventions on such other major issues as climate change and biological diversity before the United Nations Conference on Environment and Development in 1992. It would also show that the nations of the industrialized North were serious about tackling the inequity in the global economy, which was the underlying reason for the destruction of the human environment.

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B. Statement by the Secretary-General of the World Meteorological Organization

20. Professor G.O.P. Obasi, Secretary-General of the World Meteorological Organization (WMO), stated that WMO had oriented its activities in full support of international efforts to protect the atmosphere, in particular the ozone layer, from harmful human interventions. Through its various scientific and technical programmes, WMO provided its member States with authoritative scientific information on the behaviour of the atmosphere, including its climate, while its Global Ozone Observing System, which had been operational since the 1950s, supplied the only data set available for determining ozone trends.

21. The assessment carried out by WMO in 1988 and 1989, in collaboration with the National Aeronautics and Space Administration of the United States and with UNEP, had confirmed the spectacular ozone losses over Antarctica during the austral spring were due to CFCs trapped in the winter circumpolar vortex. Such reductions would occur for many decades, even after a complete phase-out of the provision and use of CFCs. The assessment also unequivocably established that there had been measurable decline in total column ozone over the northern and southern hemisphere mid-latitudes during the previous two decades. WMO data from stations in central Europe and Canada also revealed a very pronounced decline of nearly 0.5 per cent a year, while recent analysis of satellite measurements over the previous 11 years indicated a two to three per cent decline in the equatorial belt. His organization therefore strongly endorsed proposals for a rapid phase-out.

22. The monitoring of concentrations of ozone and ozone-depleting gases should be improved in order to evaluate the situation with greater precision. With that in mind, the WMO Executive Council decided in 1989 to establish a special fund for climate and atmospheric environment studies, for a total of $US 22 million, $US 7-8 million of which would be used to improve ozone monitoring capabilities, including assistance to developing countries in improving their networks. He appealed to participants to facilitate contributions by their Governments to the fund and observed, in that connection, that additional resources for WMO to carry out the tasks assigned to it under the Vienna Convention were slow in arriving.

C. General debate

23. General statements were then made by representatives of 50 States, including 11 non-Parties, 1 regional economic integration organization and 4 non-governmental organizations. Discussion focused on the proposed amendments and adjustments to the Protocol, and the proposals for a financial mechanism and the transfer of technology.

24. Many representatives from the developed countries were in favour of the proposed amendments and adjustments and wished to bring forward the date for the phasing out of CFCs to 1997, to achieve a reduction of 85 per cent in carbon tetrachloride by 1995 and reductions in methyl chloroform by the year 2000. Further limitations on halons were suggested. Many representatives of developed countries also reported that their national programmes were well ahead of the Protocol's scheduled dates and were more comprehensive with

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regard to controlled substances. A number of those delegations reported understanding and co-operation from national industries; some reported success by using a mixture of incentives and taxation measures, while others observed that setting deadlines, for example for the temporary use and eventual phase-out of HCFCs, encouraged industry to seek replacement substances with no ozone-depleting potential.

25. Several representatives of developing countries pointed out defects in the current operation of the Montreal Protocol. One such representative stated that potential investors had to be turned away because of the CFC quota imposed on national industries, and that developing countries were being asked to reduce production and consumption to a level 70 per cent below that of developed countries. Another such representative said that the conditions attached to strengthening the Protocol must be consistent with third world development.

26. On the general issue of the financial mechanism and technology transfer, several representatives of developing countries, some citing their country's debt problems, stated that their countries would need more co-operation, both financial and technological, with the developed countries, if they were to meet the deadlines laid down in the Protocol; one such representative said that the present offers of co-operation were inadequate. Other representatives pointed out that the disastrous environmental pollution in their countries would make compliance very difficult, although they were anxious to respect their obligations.

27. In respect of the financial mechanism, there was general agreement on the need for good faith between countries and equitable sharing. A number of representatives of developed countries referred to their country's responsibilities on the "polluter pays" principle. Some stated that their country's contribution to the Multilateral Fund would not in any way affect their other development assistance programmes. With regard to fixing contributions to the Multilateral Fund, a number of delegations proposed the use of the United Nations scale of assessments while others proposed a scale based on 1986 consumption of controlled substances. On the matter of "equitable sharing", several representatives mentioned the need for financing without conditionality while one suggested that guidelines were required in order to ensure that country studies, which were used for assessing incremental financing and for identifying the needs of developing countries, were made on a comparable basis, with the assistance of consultants.

28. The question of the appropriate administration for the financial mechanism was mentioned. An intergovernmental organization and a number of representatives of developing countries said that they would prefer it to be under the direct authority of the Parties through an executive committee. One representative urged that the executive committee be established forthwith, and another offered to host its first meeting, defraying the administrative cost of organizing the meeting and costs associated with developing country participation. Several delegations expressed interest in serving on the executive committee. The representative of a major potential contributor said that his country agreed to the programme of technical financial co-operation

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provided that it did not create a new bureaucracy, that it used UNEP to manage the clearing-house functions, the World Bank to finance the needed investments, and UNDP to assist in feasibility and pre-investment studies. He added that the programme should not be viewed as a precedent for other issues or negotiations, where conditions might well be different. Another delegation envisaged the role of the World Bank as being that of a consultant.

29. A number of representatives referred to the conditions for transfer of technology. Several delegations referred to the need for fairly priced substitutes and technology. Real co-operation with and understanding by industry was indispensable, because protection of the environment should not be turned into an opportunity for a few enterprises to make exorbitant profits. Another representative mentioned the importance of co-operation from multinationals. A representative of a developing country expressed concern that, while developed countries designed national laws to prevent the transfer of ozone-destructive technology, they professed themselves unable to guarantee the transfer of ozone-friendly technologies. Another representative urged that technological information be shared, and one developing country delegation considered that the transfer of technology should be free of charge. The representatives of two developing countries that are major food producers pointed out the importance of refrigeration to their economies.

30. While it was generally agreed that recent scientific data left no doubt that the ozone layer was in peril over both Antartica and the Arctic, a number of delegations called attention to the need for greater scientific knowledge about the situation and some mentioned in that connection that their respective countries were launching meteorological satellites to monitor the ozone layer.

31. Several delegations mentioned the special concern of their respective countries in view of their geographical location in either the high southern or high northern latitudes. Some observed that new types of threat to the ozone layer were emerging with the development of high-altitude supersonic aircraft and the increased number of heavy rockets and space shuttles.

32. Many delegations urged that all countries should be encouraged to become Parties to the Protocol. One delegation proposed that special assistance should be extended to non-Party developing countries. The representatives of one non-Party pointed out that the financial mechanism to be established would be a temporary arrangement to cover the period 1991-1993 and that final agreement on the article relating to the transfer of technology was not assured; however, the country concerned would seriously consider acceding to the Protocol. The representative of another developing country not Party to the Protocol pointed out that his country fell awkwardly between the provisions of Article 2 and Article 5 of the Protocol, because of its level of per capita consumption of the controlled substances. He urged that an attempt should be made to accommodate such countries in the Protocol as soon as possible.

33. Many delegations expressed the hope that a successful outcome to the current negotiations on the Protocol would pave the way for further concerted measures to protect the environment, particularly in respect of climate change and global warming. Reference was made to the desirability of presenting to the 1992 Conference on Environment and Development a draft convention on climate.

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34. One observer group stated that the crucial issue which participants needed to resolve was the amount of production of CFCs to be allowed up to the date when phase-out was completed. The proposals of the Executive Director of UNEP led to a global estimate of 5.5 million tonnes. The European Community's proposals implied about 2 million tonnes. That was a wide divergence. Bearing in mind the more alarming picture painted by recent findings, the observer group urged delegates to incline towards a low rather than a high production tonnage. With regard to methyl chloroform, it stated that it would be feasible to require production to be terminated by 1992.

35. Another observer group expressed concern about the direction being taken by the meeting. It seemed that delegations would be satisfied if they reached agreement on measures which would allow pollution levels to climb by 50 per cent by the time CFC phase-out was completed. Nobody could claim that that would be a safe outcome for future generations nor that the decision had been reached in ignorance of the risks. If some countries could phase out CFCs rather quickly, why should not other advanced industrialized countries be able to do the same? On the financial issues involved, it had no doubt that if the wealthier countries were sincerely concerned about halting the depletion of the ozone layer, they could raise much larger sums than had been mentioned, for application in developing countries as well as in their own.

36. A third observer group expressed dissatisfaction with the amount of progress made. The Vienna Convention signalled agreement to save the ozone layer and endorsed the precautionary principle. Subsequent events showed reaction rather than action as the ruling principle. It estimated that the proposed amendments to the Protocol could lead to the production of about 17 million tonnes of CFCs before phase-out was complete. Phase-out of HCFCs could feasibly be set for an earlier date. As proposals stood, it was doubtful whether the new international fund would be financially adequate; moreover, the obligations to provide technology assistance to developing countries should be made clearer and more explicit.

37. A delegate from the Australian youth delegation said that words uttered in the name of Governments were not always matched by deeds. She appealed to participants to make decisions which would reflect inter-generational equity. Young people realized that their fate was tied to what happened to the words appearing in square brackets in texts under negotiation, and they were apprehensive of the outcome.

D. Action by the Meeting

38. Under agenda items 3, 4 and 5, the Meeting had before it the reports of the Secretariat on the status of implementation of the Protocol (UNEP/Pro.OzL.Pro.2/2 and Corr.1, Add.1 and Add.3), on data submitted to the Secretariat on production, imports and exports of controlled substances (UNEP/Ozl.Pro.2/2/Add.4/Rev.1) and on financial implications and arrangements, including the adoption of a revised budget (UNEP/OzL.Pro.2/2/Add.5 and Corr.1 and 2). It also had before it a draft non-compliance procedure (UNEP/OzL.Pro.2/L.1) recommended by the Ad Hoc Working Group of Legal Experts on Non-Compliance in accordance with decision 8 (a) of the First Meeting of the Parties and draft texts submitted for its consideration by the Open-Ended Working Group of the Parties, including a draft resolution (UNEP/OzL.Pro.2/L.2), draft adjustments to the Protocol (UNEP/OzL.Pro.2/L.3), a draft Amendment to the Protocol (UNEP/OzL.Pro.2/L.4/Rev.1), draft decisions (UNEP/OzL.Pro.2/L.5/Rev.1) and appendices to draft decision II/8 (UNEP/OzL.Pro.2/L.6).

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39. After extensive deliberations, the Meeting agreed on amended versions of the draft adjustments to the Protocol, the draft Amendment to the Protocol, the draft decisions and the appendices to draft decisions II/8 that had been submitted to it by the Open-Ended Working Group. These amended texts, contained, respectively, in documents UNEP/OzL.Pro.2/L.3/Rev.1, UNEP/OzL.Pro.2/L.4/Rev.2, UNEP/OzL.Pro.2/L.5/Rev.2 and L.9/Rev.1, L.11 and L.14, and UNEP/OzL.Pro.2/L.6/Rev.1, together with the draft procedure on non-compliance (UNEP/OzL.Pro.2/L.1), were adopted by the Meeting at its final session, on 29 June 1990, by consensus and, except as noted in paragraphs 41-43 below, without comment or further amendment, as reflected in the following section.

IV. DECISIONS

40. The Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer decided:

Decision II/1. Adjustments and reductions

- To adopt in accordance with the procedure laid down in paragraphs 4 and 9 of Article 2 of the Montreal Protocol the adjustments and reductions of production and consumption of the controlled substances listed in Annex A to the Protocol, as set out in Annex I to the report on the work of the Second Meeting of the Parties;

Decision II/2. Amendment of the Protocol

- To adopt in accordance with the procedure laid down in paragraph 4 of Article 9 of the Vienna Convention for the Protection of the Ozone Layer, the Amendment to the Montreal Protocol as set out in Annex II to the report on the work of the Second Meeting of the Parties;

Decision II/3. Halons

- To establish an *ad hoc* working group of experts to investigate, and make recommendations to the Fourth Meeting of the Parties in 1992 on, the availability of substitutes for halons, the need to define essential uses of halons, methods of implementation and, if there is such a need, the identification of such uses;

Decision II/4. Isomers

- To clarify the definition of "controlled substance" in paragraph 4 of Article 1 of the Protocol so that it is understood to include the isomers of such substances except as specified in the relevant Annex;

Decision II/5. Non-compliance

- To adopt, on an interim basis, the procedures and institutional mechanisms for determining non-compliance with the provisions of the Protocol and for treatment of Parties found to be in non-compliance, as set out in Annex III to the report on the work of the Second Meeting of the Parties;

- To extend the mandate of the open-ended *Ad Hoc* Working Group of Legal Experts to elaborate further procedures on non-compliance and

Decision II/6. Article 19 (Withdrawal)

- To agree that the phrase "at any time after four years of assuming the obligations" in Article 19 should be understood to mean at any time after four years after a Party's obligation to comply became operative;

Decision II/7. Montreal Protocol Handbook

- To invite the Executive Director to prepare as soon as possible a Montreal Protocol Handbook setting out the Protocol as adjusted, the Protocol as adjusted and amended and the decisions of the Parties that relate to its interpretation and other material relevant to its operation, and to update the Handbook, as necessary, after each meeting of the Parties;

Decision II/8 Financial Mechanism

- To establish for the three-year period from 1 January 1991 to 31 December 1993 or until such time as the Financial Mechanism is established, an Interim Financial Mechanism according to the following:

1. The Interim Financial Mechanism is established for the purposes of providing financial and technical co-operation, including the transfer of technologies, to Parties operating under paragraph 1 of Article 5 of the Montreal Protocol to enable their compliance with the control measures set out in Articles 2A to 2E of the Protocol. The Mechanism, contributions to which shall be additional to other financial transfers to Parties operating under that paragraph, shall meet all agreed incremental costs of such Parties, in order to enable their compliance with the control measures of the Protocol. An indicative list of the categories of incremental costs is attached as Appendix I to this decision.*

2. The Mechanism established under paragraph 1 shall include a Multilateral Fund. It may also include other means of multilateral, regional and bilateral co-operation.

3. The Multilateral Fund shall:

(a) Meet, on a grant or concessional basis as appropriate, and according to criteria to be decided upon by the Parties, the agreed incremental costs;

(b) Finance clearing-house functions to:

(i) Assist Parties operating under paragraph 1 of Article 5, through country-specific studies and other technical co-operation, to identify their needs for co-operation;

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* The appendices to this decision are contained in annex IV of the present report.

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(ii) Facilitate technical co-operation to meet these identified needs;

(iii) Distribute, as provided for in Article 9 of the Protocol, information and relevant materials, and hold workshops, training sessions and other related activities for the benefit of Parties that are developing countries; and

(iv) Facilitate and monitor other multilateral, regional and bilateral co-operation available to Parties that are developing countries; and

(c) Finance the secretarial services of the Multilateral Fund and related support costs.

4. The Multilateral Fund shall operate under the authority of the Parties who shall decide on its overall policies.

5. The President of the Second Meeting of the Parties shall ensure that the Executive Committee establishes, with effect from 1 January 1991, an "Interim Multilateral Fund for the Implementation of the Montreal Protocol" and draws up the financial regulations and rules of the Fund.

6. The Parties hereby establish an Executive Committee to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources for the purpose of achieving the objectives of the Multilateral Fund. It is established for a three-year period. Before the end of that three-year period, the terms of reference of the Executive Committee shall be reviewed by the meeting of the Parties. The Executive Committee shall discharge its tasks and responsibilities specified in its terms of reference as agreed by the Parties, with the co-operation and assistance of the International Bank for Reconstruction and Development (World Bank), the United Nations Environment Programme, the United Nations Development Programme, or other appropriate agencies depending on their respective areas of expertise. The members of the Executive Committee, which shall be selected on the basis of a balanced representation of the Parties operating under paragraph 1 of Article 5 and of the Parties not so operating shall be endorsed by the Parties. The terms of reference of the Executive Committee are attached as Appendix II to this decision.*

7. The Multilateral Fund shall be financed by contributions from Parties not operating under paragraph 1 of Article 5 in convertible currency or, in certain circumstances, in kind and/or in national currency, on the basis of the United Nations scale of assessments as set out in Appendix III to this decision.* Contributions by other Parties shall be encouraged. Bilateral and, in particular cases

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* The appendices to this decision are contained in annex IV of the present report.

agreed by a decision of the Parties, regional co-operation may, up to twenty per cent and consistent with any criteria specified by decision of the Parties, be considered as a contribution to the Multilateral Fund, provided that such co-operation as a minimum:

(a) Strictly relates to compliance with the provisions of the Protocol;

(b) Provides additional resources; and

(c) Meets agreed incremental costs.

The terms of reference of the Multilateral Fund are attached as Appendix IV to the present decision.*

8. The Parties shall decide upon the programme budget of the Multilateral Fund for each fiscal period and upon the percentage of contributions of the individual Parties thereto.

9. Resources under the Multilateral Fund shall be disbursed with the concurrence of the beneficiary Party.

10. Decisions by the Parties under this decision shall be taken by consensus whenever possible. If all efforts at consensus have been exhausted and no agreement reached, decisions shall be adopted by a two-thirds majority vote of the Parties present and voting, representing at least a majority of the Parties operating under paragraph 1 of Article 5 present and voting and at least a majority of the Parties not so operating present and voting.

11. The Financial Mechanism set out in this decision is without prejudice to any future arrangements that may be developed with respect to other environmental issues.

12. References to dollars ($) in the appendices to this decision are to United States dollars.

Decision II/8 A. Budget for the Fund Secretariat

- To adopt the provisional budget for the Fund Secretariat as attached in Annex V of the report on the work of the Second Meeting of the Parties and to request the Executive Committee of the Parties to present to the Third Meeting of the Parties a revised version of the budget in the light of the experience gained during its implementation;

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* The appendices to this decision are contained in annex IV of the present report.

Decision II/8 B. Acceptance of offer of Canada

- To accept the offer of Canada:

    (a) To host the Executive Committee meetings as necessary during the interim period;

    (b) To support participation of developing countries in those meetings; and

    (c) To assume the administrative costs of those initiatives.

Decision II/9. Data reporting

- To establish an ad hoc group of experts to consider the reasons leading to the difficulties faced by some countries in reporting data as required by Article 7 of the Protocol and to recommend possible solutions to the Parties concerned and to report on its progress to the Third Meeting of the Parties; and

- To confirm that any data on consumption of the controlled substances that are submitted to the Secretariat as required by Article 7 of the Protocol are not to be confidential;

Decision II/10. Data of developing countries

- To ask the Secretariat to determine from the data available to it the exact quantities of the controlled substances required by developing countries operating under paragraph 1 of Article 5 and the possible sources of supply to assist developed countries to authorize their companies to produce the additional amounts needed within the percentages authorized by Article 2 and Articles 2A to 2E of the Protocol;

- To request the Secretariat to publish in its annual report on data an updated list of developing countries which, on the basis of complete data submissions, are considered to be operating under paragraph 1 of Article 5. The Secretariat shall also publish a list of developing countries that, having submitted incomplete or estimated data, appear to qualify as Parties operating under paragraph 1 of Article 5. In accordance with the provisions of Article 5 of the Protocol, no Party will be eligible for paragraph 1 of Article 5 treatment until it submits complete data to the Secretariat establishing that its annual calculated per capita level of consumption is below 0.3 kg;

Decision II/11. Destruction technologies

- To establish an ad hoc technical advisory committee on destruction technologies and to appoint its Chairman, who shall appoint in consultation with the Secretariat up to nine other members on the basis of nomination by Parties. The members shall be experts on destruction technologies and selected with due reference to equitable geographical distribution;

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- The committee shall analyse destruction technologies and assess their efficiency and environmental acceptability and develop approval criteria and measurements. The committee shall report regularly to meetings of the Parties;

Decision II/12. Customs Co-operation Council

- To agree with the recommendations adopted by the Customs Co-operation Council that all member administrations take actions to reflect the adopted subheadings in their national statistical nomenclatures as soon as possible, and to ask the Secretariat to inform the Council that the Parties, having determined that additional subheadings for individual chemicals controlled by the Montreal Protocol would be useful in their efforts to protect the ozone layer, request the assistance of the Council in this regard;

Decision II/13. Assessment panels

- To request the Technology Review Panel to assess, in accordance with Article 6, the earliest technically feasible dates and the costs for reductions and total phase-out of 1,1,1-trichloroethane (methyl chloroform) and to report its findings in time for consideration by the preparatory meeting to the Fourth Meeting of the Parties with a view to their consideration at that Fourth Meeting;

- To request the Secretariat to convene members of each of the four assessment panels established by the First Meeting of the Parties to review new information and to consider its inclusion in supplementary reports in time for consideration by the Fourth Meeting of the Parties, subject to a review of their mandate in the context of Article 2, paragraph 9, at the Third Meeting of the Parties;

- To request the Technology Review Panel to include in its work:

  (a) An evaluation of the need for transitional substances in specific applications;

  (b) An analysis of the quantity of controlled substances required by Parties operating under paragraph 1 of Article 5 for their basic domestic needs, both at present and in the future, and the likely availability of such supplies; and

  (c) A comparison of the toxicity, flammability, energy efficiency implications and other environmental and safety considerations of chemical substitutes, along with an analysis of the likely availability of substitutes for medical uses;

- To request the Scientific Assessment Panel to include in its work:

  (a) An evaluation of the ozone-depletion potential, other possible ozone layer impacts, and global warming potential of chemical substitutes (e.g. HCFCs and HFCs) for controlled substances;

  (b) An evaluation of the likely ozone-depletion potential of "other halons" that might be produced in significant quantities; and

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(c) An analysis of the anticipated impact on the ozone layer of the revised control measures reflecting the changes adopted at the Second Meeting of the Parties taking into account the current level of global participation in the Protocol;

- To instruct the Scientific Assessment Panel to prepare estimated data on the impacts on the ozone layer of engine emissions from high-altitude aircraft, heavy rockets and space shuttles;

- To undertake efforts to encourage broad participation in all assessment panels by experts from developing countries;

Decision II/14. Workplans required by Articles 9 and 10 of the Protocol

- To request the Executive Committee under the Financial Mechanism and the Secretariat to take into account in their work the recommendations on workplans required by Article 9 and Article 10 of the Protocol, as adopted by the third session of the first meeting of the Open-Ended Working Group of the Parties to the Protocol;

Decision II/15. Extension of the mandate of the Open-Ended Working Group of the Parties

- To continue the work of the Open-Ended Working Group of the Parties and to extend its mandate to consider, if necessary and in particular, the following topics:

(a) Further elaboration of any remaining details of the various components of the Financial Mechanism;

(b) Identification of the most appropriate modalities for the transfer of technologies designed for the protection of the ozone layer;

(c) Co-operation with Parties that are developing countries for the implementation of the Protocol; and

(d) Problems arising under the trade provisions of the Protocol, in respect of both trade between Parties and trade with non-Parties including issues related to free-trade zones;

and to make recommendations to the Third Meeting of the Parties;

Decision II/16. Amendment of the Vienna Convention

- To recommend that the Parties to the Vienna Convention for the Protection of the Ozone Layer review, at the earliest opportunity, Article 9 of the Convention with a view to expediting the amendment procedure for protocols;

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Decision II/17. Budget

- To adopt the system of rolling biennial budgets, and to approve a total revised budget of $3,400,000 for 1990, a total revised budget for 1991 of $2,423,000 and a total budget for 1992 of $2,225,000. The details of the approved budgets are presented in Annex VI to the report on the work of the Second Meeting of the Parties;

Decision II/18. Meetings of the Open-Ended Working Group

- To authorize the Secretariat to convene, if necessary, up to six meetings of the Open-Ended Working Group of the Parties prior to the Third Meeting of the Parties and to invite non-Parties to participate in the deliberations of these meetings;

Decision II/19. Rules of procedure for meetings of the Parties

- To amend paragraph 1 of rule 21 of the rules of procedure, adopted at the First Meeting of the Parties, to include the following additional sentences:

> "In electing its officers, the Meeting of the Parties shall have due regard to the principle of equitable geographical representation. The offices of President and Rapporteur of the Meeting of the Parties shall normally be subject to rotation among the five groups of States referred to in section I, paragraph 1, of General Assembly resolution 2997 (XXVII) of 15 December 1972, by which the United Nations Environment Programme was established.";

Decision II/20. Third Meeting of the Parties

- To convene the Third Meeting of the Parties from 19 to 21 June 1991 in conjuction with and at the same venue as the second meeting of the Conference of the Parties to the Vienna Convention.

Comments made at the time of adoption of the decisions

Decision II/2

41. Following the adoption of decision II/2, the representative of India said that the original text of the Protocol had contained provisions which discriminated against developing countries: the amended text met many of their concerns. She would therefore recommend it to the Government of India for signature.

42. The representative of China said that useful progress had been made. He would recommend to the Chinese Government that it should ratify the amended text.

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Decision II/8

43. In introducing draft decision II/8, the President drew attention to an earlier statement by the delegation of Ireland, speaking as the President of the Council of Ministers of the Environment of the European Communities, in which it had stated that the European Economic Community, which was a Party to the Montreal Protocol, would not be able to contribute to the Multilateral Fund and that the contributions of all other paying Parties would have to rise by a small percentage in consequence. With that provisio, draft decision II/8 and the scale of contributions as it appears in appendix III to that decision were adopted.

V. CONSTITUTION OF THE COMMITTEES ESTABLISHED BY THE DECISIONS OF THE SECOND MEETING OF THE PARTIES

A. Executive Committee established by decision II/8

44. Pursuant to paragraphs 2 and 3 of the terms of reference of the Executive Committee laid down in appendix II of decision II/8 (annex IV to the present report), the Meeting endorsed the selection by the groups concerned of following States to serve on the first Executive Committee:

(a) Parties not operating under paragraph 1 of Article 5 of the Protocol: Canada, Federal Republic of Germany, Finland, Japan, Netherlands, United States of America and Union of Soviet Socialist Republics;

(b) Parties operating under paragraph 1 of Article 5 of the Protocol: Brazil, Egypt, Ghana, Jordan, Malaysia, Mexico and Venezuela.

The Meeting further endorsed the selection of Finland to act as Chairman and of Mexico to act as Vice-Chairman for the first year of the Executive Committee.

45. The President pointed out that the selection of nominees had been endorsed on the understanding that, within the three-year mandate of the Executive Committee, members representing either one or the other of the two groups referred to in paragraph 2 of the terms of reference of the Committee could be changed in accordance with the wishes of the group concerned.

46. The representative of Trinidad and Tobago said that small islands and low-lying countries were particularly threatened by changes in the environment. He hoped that in future their interests could be explicitly represented in decision-making bodies.

B. Implementation Committee established by decision II/5

47. Pursuant to paragraph 3 of the non-compliance procedure adopted by its decision II/5, the meeting elected the following Parties to serve on the Implementation Committee established under the non-compliance procedure: Japan, Norway, Trinidad and Tobago, Hungary and Uganda, with the understanding arrived at during the informal consultations that the two last mentioned States were elected for a one-year term.

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C. Ad Hoc Technical Advisory Committee on Destruction Technologies

48. Pursuant to the first paragraph of decision II/11, the Meeting appointed Canada as Chairman of the *Ad Hoc* Technical Advisory Committee on Destruction Technologies.

VI. DECLARATIONS AND RESOLUTIONS

A. Declarations

49. The representative of New Zealand drew attention to the following declaration by Australia, Austria, Belgium, Canada, Denmark, Finland, Federal Republic of Germany, Liechtenstein, Netherlands, New Zealand, Norway, Sweden and Switzerland:

> "THE HEADS OF DELEGATIONS OF THE ABOVE GOVERNMENTS REPRESENTED AT THE SECOND MEETING OF THE PARTIES TO THE MONTREAL PROTOCOL,
>
> "CONCERNED of the recent scientific findings on severe depletion of ozone layer of both Southern and Northern Hemispheres,
>
> "MINDFUL that all CFCs are also powerful greenhouse gases leading to global warming,
>
> "CONVINCED of the availability of more environmentally suitable alternative substances or technologies, and
>
> "CONVINCED of the need to further tighten control measures of CFCs beyond the Protocol adjustments agreed by the Parties to the Montreal Protocol,
>
> "DECLARE
>
> "Their firm determination to take all appropriate measures to phase-out the production and consumption of all fully halogenated chlorofluorocarbons controlled by the Montreal Protocol, as adjusted and amended, as soon as possible but not later than 1997."

50. The representative of the Commission of the European Communities said that the Commission wished to associate itself with the above declaration. It had reluctantly accepted a programme of reductions for CFCs which did not give the degree of protection for the ozone layer that the Community considered necessary. The latest scientific evidence in ozone depletion over high northern and southern latitudes, as well as the increasing preoccupation with the green-house properties of CFCs, required that the Parties reconsidered its decision; that review should take place within the context of the review foreseen for 1992 with a view to the complete elimination of CFCs at the earliest possible date.

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B. Resolution by the Governments and the European Communities represented at the Second Meeting of the Parties

51. The Governments and the European Communities represented at the Meeting adopted an amended version (UNEP/OzL.Pro.2/L.2/Rev.1) of the draft resolution submitted for the consideration of the Meeting by the Open-Ended Working Group. The text of the resolution as adopted appears in annex VII to the present report.

VII. OTHER MATTERS

52. There were no other matters.

VIII. ADOPTION OF THE REPORT

53. The Meeting adopted the present report, on the basis of the draft report contained in document UNEP/OzL.Pro.2/L.7, at its closing session, on 29 June 1990.

IX. CLOSURE OF THE MEETING

54. After the customary exchange of courtesies, the President declared the meeting closed at 9.30 p.m. on Friday, 29 June 1990.

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Annex I

ADJUSTMENTS TO THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

The Second Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer decides, on the basis of assessments made pursuant to Article 6 of the Protocol, to adopt adjustments and reductions of production and consumption of the controlled substances in Annex A to the Protocol, as follows, with the understanding that:

(a) References in Article 2 to "this Article" and throughout the Protocol to "Article 2" shall be interpreted as references to Articles 2, 2A and 2B;

(b) References throughout the Protocol to "paragraphs 1 to 4 of Article 2" shall be interpreted as references to Articles 2A and 2B; and

(c) The reference in paragraph 5 of Article 2 to "paragraphs 1, 3 and 4" shall be interpreted as a reference to Article 2A.

A. Article 2A: CFCs

Paragraph 1 of Article 2 of the Protocol shall become paragraph 1 of Article 2A, which shall be entitled "Article 2A: CFCs". Paragraphs 3 and 4 of Article 2 shall be replaced by the following paragraphs, which shall be numbered paragraphs 2 to 6 of Article 2A:

> 2. Each Party shall ensure that for the period from 1 July 1991 to 31 December 1992 its calculated levels of consumption and production of the controlled substances in Group I of Annex A do not exceed 150 per cent of its calculated levels of production and consumption of those substances in 1986; with effect from 1 January 1993, the twelve-month control period for these controlled substances shall run from 1 January to 31 December each year.
>
> 3. Each Party shall ensure that for the twelve-month period commencing on 1 January 1995, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed, annually, fifty per cent of its calculated level of consumption in 1986. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, fifty per cent of its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1986.

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4. Each Party shall ensure that for the twelve-month period commencing on 1 January 1997, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed, annually, fifteen per cent of its calculated level of consumption in 1986. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, fifteen per cent of its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1986.

5. Each Party shall ensure that for the twelve-month period commencing on 1 January 2000, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex A does not exceed zero. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed zero. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1986.

6. In 1992, the Parties will review the situation with the objective of accelerating the reduction schedule.

B. Article 2B: Halons

Paragraph 2 of Article 2 of the Protocol shall be replaced by the following paragraphs, which shall be numbered paragraphs 1 to 4 of Article 2B:

Article 2B: Halons

> 1. Each Party shall ensure that for the twelve-month period commencing on 1 January 1992, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group II of Annex A does not exceed, annually, its calculated level of consumption in 1986. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1986.
>
> 2. Each Party shall ensure that for the twelve-month period commencing on 1 January 1995, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group II of Annex A does not exceed, annually, fifty per cent of its calculated level of consumption in 1986. Each Party

/...

producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, fifty per cent of its calculated level of production in 1986. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1986. This paragraph will apply save to the extent that the Parties decide to permit the level of production or consumption that is necessary to satisfy essential uses for which no adequate alternatives are available.

3. Each Party shall ensure that for the twelve-month period commencing on 1 January 2000, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group II of Annex A does not exceed zero. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed zero. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1986. This paragraph will apply save to the extent that the Parties decide to permit the level of production or consumption that is necessary to satisfy essential uses for which no adequate alternatives are available.

4. By 1 January 1993, the Parties shall adopt a decision identifying essential uses, if any, for the purposes of paragraphs 2 and 3 of this Article. Such decision shall be reviewed by the Parties at their subsequent meetings.

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Annex II

AMENDMENT TO THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

ARTICLE 1: AMENDMENT

A. Preambular paragraphs

1. The 6th preambular paragraph of the Protocol shall be replaced by the following:

> Determined to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations and bearing in mind the developmental needs of developing countries,

2. The 7th preambular paragraph of the Protocol shall be replaced by the following:

> Acknowledging that special provision is required to meet the needs of developing countries, including the provision of additional financial resources and access to relevant technologies, bearing in mind that the magnitude of funds necessary is predictable, and the funds can be expected to make a substantial difference in the world's ability to address the scientifically established problem of ozone depletion and its harmful effects,

3. The 9th preambular paragraph of the Protocol shall be replaced by the following:

> Considering the importance of promoting international co-operation in the research, development and transfer of alternative technologies relating to the control and reduction of emissions of substances that deplete the ozone layer, bearing in mind in particular the needs of developing countries,

B. Article 1: Definitions

1. Paragraph 4 of Article 1 of the Protocol shall be replaced by the following paragraph:

> 4. "Controlled substance" means a substance in Annex A or in Annex B to this Protocol, whether existing alone or in a mixture. It includes the isomers of any such substance, except as specified in the relevant Annex, but excludes any controlled substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance.

/...

2. Paragraph 5 of Article 1 of the Protocol shall be replaced by the following paragraph:

> 5. "Production" means the amount of controlled substances produced, minus the amount destroyed by technologies to be approved by the Parties and minus the amount entirely used as feedstock in the manufacture of other chemicals. The amount recycled and reused is not to be considered as "production".

3. The following paragraph shall be added to Article 1 of the Protocol:

> 9. "Transitional substance" means a substance in Annex C to this Protocol, whether existing alone or in a mixture. It includes the isomers of any such substance, except as may be specified in Annex C, but excludes any transitional substance or mixture which is in a manufactured product other than a container used for the transportation or storage of that substance.

C. Article 2, paragraph 5

Paragraph 5 of Article 2 of the Protocol shall be replaced by the following paragraph:

> 5. Any Party may, for any one or more control periods, transfer to another Party any portion of its calculated level of production set out in Articles 2A to 2E, provided that the total combined calculated levels of production of the Parties concerned for any group of controlled substances do not exceed the production limits set out in those Articles for that group. Such transfer of production shall be notified to the Secretariat by each of the Parties concerned, stating the terms of such transfer and the period for which it is to apply.

D. Article 2, paragraph 6

The following words shall be inserted in paragraph 6 of Article 2 before the words "controlled substances" the first time they occur:

> Annex A or Annex B

E. Article 2, paragraph 8 (a)

The following words shall be added after the words "this Article" wherever they appear in paragraph 8 (a) of Article 2 of the Protocol:

> and Articles 2A to 2E

F. Article 2, paragraph 9 (a) (i)

The following words shall be added after "Annex A" in paragraph 9 (a) (i) of Article 2 of the Protocol:

> and/or Annex B

/...

G. Article 2, paragraph 9 (a) (ii)

The following words shall be deleted from paragraph 9 (a) (ii) of Article 2 of the Protocol:

> from 1986 levels

H. Article 2, paragraph 9 (c)

The following words shall be deleted from paragraph 9 (c) of Article 2 of the Protocol:

> representing at least fifty per cent of the total consumption of the controlled substances of the Parties

and replaced by:

> representing a majority of the Parties operating under paragraph 1 of Article 5 present and voting and a majority of the Parties not so operating present and voting

I. Article 2, paragraph 10 (b)

Paragraph 10 (b) of Article 2 of the Protocol shall be deleted, and paragraph 10 (a) of Article 2 shall become paragraph 10.

J. Article 2, paragraph 11

The following words shall be added after the words "this Article" wherever they occur in paragraph 11 of Article 2 of the Protocol:

> and Articles 2A to 2E

K. Article 2C: Other fully halogenated CFCs

The following paragraphs shall be added to the Protocol as Article 2C:

Article 2C: Other fully halogenated CFCs

> 1. Each Party shall ensure that for the twelve-month period commencing on 1 January 1993, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex B does not exceed, annually, eighty per cent of its calculated level of consumption in 1989. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, eighty per cent of its calculated level of production in 1989. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

2. Each Party shall ensure that for the twelve-month period commencing on 1 January 1997, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex B does not exceed, annually, fifteen per cent of its calculated level of consumption in 1989. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed, annually, fifteen per cent of its calculated level of production in 1989. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

3. Each Party shall ensure that for the twelve-month period commencing on 1 January 2000, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substances in Group I of Annex B does not exceed zero. Each Party producing one or more of these substances shall, for the same periods, ensure that its calculated level of production of the substances does not exceed zero. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1989.

L. Article 2D: Carbon tetrachloride

The following paragraphs shall be added to the Protocol as Article 2D:

Article 2D: Carbon tetrachloride

1. Each Party shall ensure that for the twelve-month period commencing on 1 January 1995, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group II of Annex B does not exceed, annually, fifteen per cent of its calculated level of consumption in 1989. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed, annually, fifteen per cent of its calculated level of production in 1989. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

2. Each Party shall ensure that for the twelve-month period commencing on 1 January 2000, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group II of Annex B does not exceed zero. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed zero. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1989.

/...

M. Article 2E: 1,1,1-trichloroethane (methyl chloroform)

The following paragraphs shall be added to the Protocol as Article 2E:

Article 2E: 1,1,1-trichloroethane (methyl chloroform)

1. Each Party shall ensure that for the twelve-month period commencing on 1 January 1993, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group III of Annex B does not exceed, annually, its calculated level of consumption in 1989. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed, annually, its calculated level of production in 1989. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

2. Each Party shall ensure that for the twelve-month period commencing on 1 January 1995, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group III of Annex B does not exceed, annually, seventy per cent of its calculated level of consumption in 1989. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed, annually, seventy per cent of its calculated level of consumption in 1989. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

3. Each Party shall ensure that for the twelve-month period commencing on 1 January 2000, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group III of Annex B does not exceed, annually, thirty per cent of its calculated level of consumption in 1989. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed, annually, thirty per cent of its calculated level of production in 1989. However, in order to satisfy the basic domestic needs of Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to ten per cent of its calculated level of production in 1989.

4. Each Party shall ensure that for the twelve-month period commencing on 1 January 2005, and in each twelve-month period thereafter, its calculated level of consumption of the controlled substance in Group III of Annex B does not exceed zero. Each Party producing the substance shall, for the same periods, ensure that its calculated level of production of the substance does not exceed zero. However, in order to satisfy the basic domestic needs of the Parties operating under paragraph 1 of Article 5, its calculated level of production may exceed that limit by up to fifteen per cent of its calculated level of production in 1989.

/...

5. The Parties shall review, in 1992, the feasibility of a more rapid schedule of reductions than that set out in this Article.

N. Article 3: Calculation of control levels

1. The following shall be added after "Articles 2" in Article 3 of the Protocol:

, 2A to 2E,

2. The following words shall be added after "Annex A" each time it appears in Article 3 of the Protocol:

or Annex B

O. Article 4: Control of trade with non-Parties

1. Paragraphs 1 to 5 of Article 4 shall be replaced by the following paragraphs:

> 1. As of 1 January 1990, each Party shall ban the import of the controlled substances in Annex A from any State not party to this Protocol.
>
> 1 *bis*. Within one year of the date of the entry into force of this paragraph, each Party shall ban the import of the controlled substances in Annex B from any State not party to this Protocol.
>
> 2. As of 1 January 1993, each Party shall ban the export of any controlled substances in Annex A to any State not party to this Protocol.
>
> 2 *bis*. Commencing one year after the date of entry into force of this paragraph, each Party shall ban the export of any controlled substances in Annex B to any State not party to this Protocol.
>
> 3. By 1 January 1992, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of products containing controlled substances in Annex A. Parties that have not objected to the annex in accordance with those procedures shall ban, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.
>
> 3 *bis*. Within three years of the date of the entry into force of this paragraph, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of products containing controlled substances in Annex B. Parties that have not objected to the annex in accordance with those procedures shall ban, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.

/...

> 4. By 1 January 1994, the Parties shall determine the feasibility of banning or restricting, from States not party to this Protocol, the import of products produced with, but not containing, controlled substances in Annex A. If determined feasible, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of such products. Parties that have not objected to the annex in accordance with those procedures shall ban, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.
>
> 4 bis. Within five years of the date of the entry into force of this paragraph, the Parties shall determine the feasibility of banning or restricting, from States not party to this Protocol, the import of products produced with, but not containing, controlled substances in Annex B. If determined feasible, the Parties shall, following the procedures in Article 10 of the Convention, elaborate in an annex a list of such products. Parties that have not objected to the annex in accordance with those procedures shall ban or restrict, within one year of the annex having become effective, the import of those products from any State not party to this Protocol.
>
> 5. Each Party undertakes to the fullest practicable extent to discourage the export to any State not party to this Protocol of technology for producing and for utilizing controlled substances.

2. Paragraph 8 of Article 4 of the Protocol shall be replaced by the following paragraph:

> 8. Notwithstanding the provisions of this Article, imports referred to in paragraphs 1, 1 bis, 3, 3 bis, 4 and 4 bis, and exports referred to in paragraphs 2 and 2 bis, may be permitted from, or to, any State not party to this Protocol, if that State is determined by a meeting of the Parties to be in full compliance with Article 2, Articles 2A to 2E, and this Article and have submitted data to that effect as specified in Article 7.

3. The following paragraph shall be added to Article 4 of the Protocol as paragraph 9:

> 9. For the purposes of this Article, the term "State not party to this Protocol" shall include, with respect to a particular controlled substance, a State or regional economic integration organization that has not agreed to be bound by the control measures in effect for that substance.

P. Article 5: Special situation of developing countries

Article 5 of the Protocol shall be replaced by the following:

> 1. Any Party that is a developing country and whose annual calculated level of consumption of the controlled substances in Annex A is less than 0.3 kilograms per capita on the date of the entry into force of the Protocol for it, or any time thereafter until 1 January 1999, shall in order to meet its basic domestic needs, be entitled to delay for ten years its compliance with the control measures set out in Articles 2A to 2E.

2. However, any Party operating under paragraph 1 of this Article shall exceed neither an annual calculated level of consumption of the controlled substances in Annex A of 0.3 kilograms per capita nor an annual calculated level of consumption of the controlled substances of Annex B of 0.2 kilograms per capita.

3. When implementing the control measures set out in Articles 2A to 2E, any Party operating under paragraph 1 of this Article shall be entitled to use:

(a) For controlled substances under Annex A, either the average of its annual calculated level of consumption for the period 1995 to 1997 inclusive or a calculated level of consumption of 0.3 kilograms per capita, whichever is the lower, as the basis for determining its compliance with the control measures;

(b) For controlled substances under Annex B, the average of its annual calculated level of consumption for the period 1998 to 2000 inclusive or a calculated level of consumption of 0.2 kilograms per capita, whichever is the lower, as the basis for determining its compliance with the control measures.

4. If a Party operating under paragraph 1 of this Article, at any time before the control measures obligations in Articles 2A to 2E become applicable to it, finds itself unable to obtain an adequate supply of controlled substances, it may notify this to the Secretariat. The Secretariat shall forthwith transmit a copy of such notification to the Parties, which shall consider the matter at their next Meeting, and decide upon appropriate action to be taken.

5. Developing the capacity to fulfil the obligations of the Parties operating under paragraph 1 of this Article to comply with the control measures set out in Articles 2A to 2E and their implementation by those same Parties will depend upon the effective implementation of the financial co-operation as provided by Article 10 and transfer of technology as provided by Article 10A.

6. Any Party operating under paragraph 1 of this Article may, at any time, notify the Secretariat in writing that, having taken all practicable steps it is unable to implement any or all of the obligations laid down in Articles 2A to 2E due to the inadequate implementation of Articles 10 and 10A. The Secretariat shall forthwith transmit a copy of the notification to the Parties, which shall consider the matter at their next Meeting, giving due recognition to paragraph 5 of this Article and shall decide upon appropriate action to be taken.

7. During the period between notification and the Meeting of the Parties at which the appropriate action referred to in paragraph 6 above is to be decided, or for a further period if the Meeting of the Parties so decides, the non-compliance procedures referred to in Article 8 shall not be invoked against the notifying Party.

/...

8. A Meeting of the Parties shall review, not later than 1995, the situation of the Parties operating under paragraph 1 of this Article, including the effective implementation of financial co-operation and transfer of technology to them, and adopt such revisions that may be deemed necessary regarding the schedule of control measures applicable to those Parties.

9. Decisions of the Parties referred to in paragraphs 4, 6 and 7 of this Article shall be taken according to the same procedure applied to decision-making under Article 10.

Q. Article 6: Assessment and review of control measures

The following words shall be added after "Article 2" in Article 6 of the Protocol:

> Articles 2A to 2E, and the situation regarding production, imports and exports of the transitional substances in Group I of Annex C

R. Article 7: Reporting of data

1. Article 7 of the Protocol shall be replaced by the following:

> 1. Each Party shall provide to the Secretariat, within three months of becoming a Party, statistical data on its production, imports and exports of each of the controlled substances in Annex A for the year 1986, or the best possible estimates of such data where actual data are not available.
>
> 2. Each Party shall provide to the Secretariat statistical data on its production, imports and exports of each of the controlled substances in Annex B and each of the transitional substances in Group I of Annex C, for the year 1989, or the best possible estimates of such data where actual data are not available, not later than three months after the date when the provisions set out in the Protocol with regard to the substances in Annex B enter into force for that Party.
>
> 3. Each Party shall provide statistical data to the Secretariat on its annual production (as defined in paragraph 5 of Article 1), and, separately,
>
> - amounts used for feedstocks,
> - amounts destroyed by technologies approved by the Parties,
> - imports and exports to Parties and non-Parties respectively,
>
> of each of the controlled substances listed in Annexes A and B as well as of the transitional substances in Group I of Annex C, for the year during which provisions concerning the substances in Annex B entered into force for that Party and for each year thereafter. Data shall be forwarded not later than nine months after the end of the year to which the data relate.

/...

4. For Parties operating under the provisions of paragraph 8 (a) of Article 2, the requirements in paragraphs 1, 2 and 3 of this Article in respect of statistical data on imports and exports shall be satisfied if the regional economic integration organization concerned provides data on imports and exports between the organization and States that are not members of that organization.

S. Article 9: Research, development, public awareness and exchange of information

Paragraph 1 (a) of Article 9 of the Protocol shall be replaced by the following:

(a) Best technologies for improving the containment, recovery, recycling, or destruction of controlled and transitional substances or otherwise reducing their emissions;

T. Article 10: Financial mechanism

Article 10 of the Protocol shall be replaced by the following:

Article 10: Financial mechanism

1. The Parties shall establish a mechanism for the purposes of providing financial and technical co-operation, including the transfer of technologies, to Parties operating under paragraph 1 of Article 5 of this Protocol to enable their compliance with the control measures set out in Articles 2A to 2E of the Protocol. The mechanism, contributions to which shall be additional to other financial transfers to Parties operating under that paragraph, shall meet all agreed incremental costs of such Parties in order to enable their compliance with the control measures of the Protocol. An indicative list of the categories of incremental costs shall be decided by the meeting of the Parties.

2. The mechanism established under paragraph 1 shall include a Multilateral Fund. It may also include other means of multilateral, regional and bilateral co-operation.

3. The Multilateral Fund shall:

(a) Meet, on a grant or concessional basis as appropriate, and according to criteria to be decided upon by the Parties, the agreed incremental costs;

(b) Finance clearing-house functions to:

(i) Assist Parties operating under paragraph 1 of Article 5, through country specific studies and other technical co-operation, to identify their needs for co-operation;

(ii) Facilitate technical co-operation to meet these identified needs;

/...

(iii) Distribute, as provided for in Article 9, information and relevant materials, and hold workshops, training sessions, and other related activities, for the benefit of Parties that are developing countries; and

(iv) Facilitate and monitor other multilateral, regional and bilateral co-operation available to Parties that are developing countries;

(c) Finance the secretarial services of the Multilateral Fund and related support costs.

4. The Multilateral Fund shall operate under the authority of the Parties who shall decide on its overall policies.

5. The Parties shall establish an Executive Committee to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources, for the purpose of achieving the objectives of the Multilateral Fund. The Executive Committee shall discharge its tasks and responsibilities, specified in its terms of reference as agreed by the Parties, with the co-operation and assistance of the International Bank for Reconstruction and Development (World Bank), the United Nations Environment Programme, the United Nations Development Programme or other appropriate agencies depending on their respective areas of expertise. The members of the Executive Committee, which shall be selected on the basis of a balanced representation of the Parties operating under paragraph 1 of Article 5 and of the Parties not so operating, shall be endorsed by the Parties.

6. The Multilateral Fund shall be financed by contributions from Parties not operating under paragraph 1 of Article 5 in convertible currency or, in certain circumstances, in kind and/or in national currency, on the basis of the United Nations scale of assessments. Contributions by other Parties shall be encouraged. Bilateral and, in particular cases agreed by a decision of the Parties, regional co-operation may, up to a percentage and consistent with any criteria to be specified by decision of the Parties, be considered as a contribution to the Multilateral Fund, provided that such co-operation, as a minimum:

(a) Strictly relates to compliance with the provisions of this Protocol;

(b) Provides additional resources; and

(c) Meets agreed incremental costs.

7. The Parties shall decide upon the programme budget of the Multilateral Fund for each fiscal period and upon the percentage of contributions of the individual Parties thereto.

/...

8. Resources under the Multilateral Fund shall be disbursed with the concurrence of the beneficiary Party.

9. Decisions by the Parties under this Article shall be taken by consensus whenever possible. If all efforts at consensus have been exhausted and no agreement reached, decisions shall be adopted by a two-thirds majority vote of the Parties present and voting, representing a majority of the Parties operating under paragraph 1 of Article 5 present and voting and a majority of the Parties not so operating present and voting.

10. The financial mechanism set out in this Article is without prejudice to any future arrangements that may be developed with respect to other environmental issues.

U. Article 10A: Transfer of technology

The following Article shall be added to the Protocol as Article 10A:

Article 10A: Transfer of technology

Each Party shall take every practicable step, consistent with the programmes supported by the financial mechanism, to ensure:

(a) That the best available, environmentally safe substitutes and related technologies are expeditiously transferred to Parties operating under paragraph 1 of Article 5; and

(b) That the transfers referred to in subparagraph (a) occur under fair and most favourable conditions.

V. Article 11: Meetings of the Parties

Paragraph 4 (g) of Article 11 of the Protocol shall be replaced by the following:

(g) Assess, in accordance with Article 6, the control measures and the situation regarding transitional substances;

W. Article 17: Parties joining after entry into force

The following words shall be added after "as well as under" in Article 17:

Articles 2A to 2E, and

X. Article 19: Withdrawal

Article 19 of the Protocol shall be replaced by the following paragraph:

Any Party may withdraw from this Protocol by giving written notification to the Depositary at any time after four years of assuming the obligations specified in paragraph 1 of Article 2A. Any such withdrawal shall take effect upon expiry of one year after the date of its receipt by the Depositary, or on such later date as may be specified in the notification of the withdrawal.

/...

Y. Annexes

The following annexes shall be added to the Protocol:

Annex B

Controlled substances

Group	Substance	Ozone-depleting potential
Group I		
CF_3Cl	(CFC-13)	1.0
C_2FCl_5	(CFC-111)	1.0
$C_2F_2Cl_4$	(CFC-112)	1.0
C_3FCl_7	(CFC-211)	1.0
$C_3F_2Cl_6$	(CFC-212)	1.0
$C_3F_3Cl_5$	(CFC-213)	1.0
$C_3F_4Cl_4$	(CFC-214)	1.0
$C_3F_5Cl_3$	(CFC-215)	1.0
$C_3F_6Cl_2$	(CFC-216)	1.0
C_3F_7Cl	(CFC-217)	1.0
Group II		
CCl_4	carbon tetrachloride	1.1
Group III		
$C_2H_3Cl_3$*	1,1,1-trichloroethane (methyl chloroform)	0.1

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* This formula does not refer to 1,1,2-trichloroethane.

Annex C

Transitional substances

Group	Substance
Group I	
$CHFCl_2$	(HCFC-21)
CHF_2Cl	(HCFC-22)
CH_2FCl	(HCFC-31)
C_2HFCl_4	(HCFC-121)
$C_2HF_2Cl_3$	(HCFC-122)
$C_2HF_3Cl_2$	(HCFC-123)
C_2HF_4Cl	(HCFC-124)
$C_2H_2FCl_3$	(HCFC-131)
$C_2H_2F_2Cl_2$	(HCFC-132)
$C_2H_2F_3Cl$	(HCFC-133)
$C_2H_3FCl_2$	(HCFC-141)
$C_2H_3F_2Cl$	(HCFC-142)
C_2H_4FCl	(HCFC-151)
C_3HFCl_6	(HCFC-221)
$C_3HF_2Cl_5$	(HCFC-222)
$C_3HF_3Cl_4$	(HCFC-223)
$C_3HF_4Cl_3$	(HCFC-224)
$C_3HF_5Cl_2$	(HCFC-225)
C_3HF_6Cl	(HCFC-226)
$C_3H_2FCl_5$	(HCFC-231)
$C_3H_2F_2Cl_4$	(HCFC-232)
$C_3H_2F_3Cl_3$	(HCFC-233)
$C_3H_2F_4Cl_2$	(HCFC-234)
$C_3H_2F_5Cl$	(HCFC-235)
$C_3H_3FCl_4$	(HCFC-241)
$C_3H_3F_2Cl_3$	(HCFC-242)
$C_3H_3F_3Cl_2$	(HCFC-243)
$C_3H_3F_4Cl$	(HCFC-244)
$C_3H_4FCl_3$	(HCFC-251)
$C_3H_4F_2Cl_2$	(HCFC-252)
$C_3H_4F_3Cl$	(HCFC-253)
$C_3H_5FCl_2$	(HCFC-261)
$C_3H_5F_2Cl$	(HCFC-262)
C_3H_6FCl	(HCFC-271)

/...

ARTICLE 2: ENTRY INTO FORCE

1. This Amendment shall enter into force on 1 January 1992, provided that at least twenty instruments of ratification, acceptance or approval of the Amendment have been deposited by States or regional economic integration organizations that are Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer. In the event that this condition has not been fulfilled by that date, the Amendment shall enter into force on the ninetieth day following the date on which it has been fulfilled.

2. For the purposes of paragraph 1, any such instrument deposited by a regional economic integration organization shall not be counted as additional to those deposited by member States of such organization.

3. After the entry into force of this Amendment as provided under paragraph 1, it shall enter into force for any other Party to the Protocol on the ninetieth day following the date of deposit of its instrument of ratification, acceptance or approval.

/...

Annex III

NON-COMPLIANCE PROCEDURE

1. If one or more Parties have reservations regarding another Party's implementation of its obligations under the Protocol, those concerns may be addressed in writing to the Secretariat. Such a submission shall be supported by corroborating information.

2. The Party whose implementation is at issue is to be given the submission and a reasonable opportunity to reply. Such reply and information in support thereof is to be submitted to the Secretariat and to the Parties involved. The Secretariat shall then transmit the submission, the reply and the information provided by the Parties, to the Implementation Committee referred to in paragraph 3, which shall consider the matter as soon as practicable.

3. An Implementation Committee is hereby established. It shall consist of five Parties elected by the Meeting of the Parties for two years, based on equitable geographical distribution. Outgoing Parties may also be re-elected for one immediate consecutive term. At the first election, two Parties shall be elected for a one-year term.

4. The Committee shall meet as necessary to perform its functions.

5. The functions of the Committee shall be to receive, consider and report on:

(a) Any submission made by one or more Parties in accordance with paragraphs 1 and 2;

(b) Any information or observations forwarded by the Secretariat in connection with the preparation of the report referred to in Article 12 (c) of the Protocol.

6. The Committee shall consider the submissions, information and observations referred to in paragraph 5 with a view to securing an amicable resolution of the matter on the basis of respect for the provisions of the Protocol.

7. The Committee shall report to the Meeting of the Parties. After receiving a report by the Committee the Parties may, taking into consideration the circumstances of the case, decide upon and call for steps to bring about full compliance with the Protocol, including measures to assist the Party's compliance with the Protocol, and to further the Protocol's objectives.

8. The Parties involved in a matter referred to in paragraph 5 shall inform, through the Secretariat, the Meeting of the Parties of the results of proceedings taken under Article 11 of the Convention regarding possible non-compliance, about implementation of those results and about implementation of any decision of the Parties pursuant to paragraph 7.

9. The Meeting of the Parties may, pending completion of proceedings initiated under Article 11 of the Convention, issue an interim call and/or recommendations.

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10. The Meeting of the Parties may request the Committee to make recommendations to assist the Meeting's consideration of cases of possible non-compliance.

11. The members of the Committee and any Party involved in its deliberations shall protect the confidentiality of information they receive in confidence.

Annex IV

APPENDICES TO DECISION II/8 ("FINANCIAL MECHANISM") ADOPTED BY THE SECOND MEETING OF THE PARTIES

Appendix I

INDICATIVE LIST OF CATEGORIES OF INCREMENTAL COSTS

1. The evaluation of requests for financing incremental costs of a given project shall take into account the following general principles:

(a) The most cost-effective and efficient option should be chosen, taking into account the national industrial strategy of the recipient party. It should be considered carefully to what extent the infrastructure at present used for production of the controlled substances could be put to alternative uses, thus resulting in decreased capital abandonment, and how to avoid deindustrialization and loss of export revenues;

(b) Consideration of project proposals for funding should involve the careful scrutiny of cost items listed in an effort to ensure that there is no double-counting;

(c) Savings or benefits that will be gained at both the strategic and project levels during the transition process should be taken into account on a case-by-case basis, according to criteria decided by the Parties and as elaborated in the guidelines of the Executive Committee;

(d) The funding of incremental costs is intended as an incentive for early adoption of ozone protecting technologies. In this respect the Executive Committee shall agree which time scales for payment of incremental costs are appropriate in each sector.

2. Incremental costs that once agreed are to be met by the financial mechanism include those listed below. If incremental costs other than those mentioned below are identified and quantified, a decision as to whether they are to be met by the financial mechanism shall be taken by the Executive Committee consistent with any criteria decided by the Parties and elaborated in the guidelines of the Executive Committee. The incremental recurring costs apply only for a transition period to be defined. The following list is indicative:

(a) Supply of substitutes

(i) Cost of conversion of existing production facilities:

- cost of patents and designs and incremental cost of royalties;

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- capital cost of conversion;
- cost of retraining of personnel, as well as the cost of research to adapt technology to local circumstances;

(ii) Costs arising from premature retirement or enforced idleness, taking into account any guidance of the Executive Committee on appropriate cut-off dates:

- of productive capacity previously used to produce substances controlled by existing and/or amended or adjusted Protocol provisions; and
- where such capacity is not replaced by converted or new capacity to produce alternatives;

(iii) Cost of establishing new production facilities for substitutes of capacity equivalent to capacity lost when plants are converted or scrapped, including:

- cost of patents and designs and incremental cost of royalties;
- capital cost;
- cost of training, as well as the cost of research to adapt technology to local circumstances;

(iv) Net operational cost, including the cost of raw materials;

(v) Cost of import of substitutes;

(b) Use in manufacturing as an intermediate good

(i) Cost of conversion of existing equipment and product manufacturing facilities;

(ii) Cost of patents and designs and incremental cost of royalties;

(iii) Capital cost;

(iv) Cost of retraining;

(v) Cost of research and development;

(vi) Operational cost, including the cost of raw materials except where otherwise provided for;

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(c) End use

(i) Cost of premature modification or replacement of user equipment;

(ii) Cost of collection, management, recycling, and, if cost effective, destruction of ozone-depleting substances;

(iii) Cost of providing technical assistance to reduce consumption and unintended emission of ozone-depleting substances.

Appendix II

TERMS OF REFERENCE OF THE EXECUTIVE COMMITTEE

1. The Executive Committee of the Parties is established to develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements including the disbursement of resources, for the purpose of achieving the objectives of the Multilateral Fund under the Financial Mechanism.

2. The Executive Committee shall consist of seven Parties from the group of Parties operating under paragraph 1 of Article 5 of the Protocol and seven Parties from the group of Parties not so operating. Each group shall select its Executive Committee members. The members of the Executive Committee shall be formally endorsed by the Meeting of the Parties.

3. The Chairman and Vice-Chairman shall be selected from the fourteen Executive Committee members. The office of Chairman is subject to rotation, on an annual basis, between the Parties operating under paragraph 1 of Article 5, and the Parties not so operating. The group of Parties entitled to the chairmanship shall select the Chairman from among their members of the Executive Committee. The Vice-Chairman shall be selected by the other group from within their number.

4. Decisions by the Executive Committee shall be taken by consensus whenever possible. If all efforts at consensus have been exhausted and no agreement reached, decisions shall be taken by a two-thirds majority of the Parties present and voting, representing a majority of the Parties operating under paragraph 1 of Article 5 and a majority of the Parties not so operating present and voting.

5. The meetings of the Executive Committee shall be conducted in those official languages of the United Nations required by members of the Executive Committee. Nevertheless the Executive Committee may agree to conduct its business in one of the United Nations official languages.

6. Costs of Executive Committee meetings, including travel and subsistence of Committee participants from Parties operating under paragraph 1 of Article 5, shall be disbursed from the Multilateral Fund as necessary.

7. The Executive Committee shall ensure that the expertise required to perform its functions is available to it.

8. The Executive Committee shall meet at least twice a year.

9. The Executive Committee shall adopt other rules of procedure on a provisional basis and in accordance with paragraphs 1 to 8 of these terms of reference. Such provisional rules of procedure shall be submitted to the next annual meeting of the Parties for endorsement. This procedure shall also be followed when such rules of procedure are amended.

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10. The functions of the Executive Committee shall include:

(a) To develop and monitor the implementation of specific operational policies, guidelines and administrative arrangements, including the disbursement of resources;

(b) To develop the three-year plan and budget for the Multilateral Fund, including allocation of Multilateral Fund resources among the agencies identified in paragraph 6 of decision II/8;

(c) To supervise and guide the administration of the Multilateral Fund;

(d) To develop the criteria for project eligibility and guidelines for the implementation of activities supported by the Multilateral Fund;

(e) To review regularly the performance reports on the implementation of activities supported by the Multilateral Fund;

(f) To monitor and evaluate expenditure incurred under the Multilateral Fund;

(g) To consider and, where appropriate, approve country programmes for compliance with the Protocol and, in the context of those country programmes, assess and, where applicable, approve all project proposals or groups of project proposals where the agreed incremental costs exceed $500,000;

(h) To review any disagreement by a Party operating under paragraph 1 of Article 5 with any decision taken with regard to a request for financing by that Party of a project or projects where the agreed incremental costs are less than $500,000;

(i) To assess annually whether the contributions through bilateral co-operation, including particular regional cases, comply with the criteria set out by the Parties for consideration as part of the contributions to the Multilateral Fund;

(j) To report annually to the meeting of the Parties on the activities exercised under the functions outlined above, and to make recommendations as appropriate;

(k) To nominate, for appointment by the Executive Director of UNEP, the Chief Officer of the Fund Secretariat, who shall work under the Executive Committee and report to it; and

(l) To perform such other functions as may be assigned to it by the Meeting of the Parties.

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Appendix III

MULTILATERAL FUND FOR THE FINANCIAL MECHANISM: SCALE OF CONTRIBUTIONS BY THE PARTIES BASED ON THE UNITED NATIONS SCALE OF ASSESSMENT WITH NO COUNTRY PAYING MORE THAN 25 PER CENT FOR 1991, 1992, AND 1993

Party	UN scale of contribution (%)	Percentages based on the United Nations scale with a 25 per cent ceiling (%)	Pledges for 1991 (US $)	Pledges for 1992 (US $)	Pledges for 1993 (US $)
Developing countries that are not operating under paragraph 1 of Article 5					
Brazil	1.45	0.00	0	0	0
Burkina Faso	0.01	0.00	0	0	0
Cameroon	0.01	0.00	0	0	0
Chile	0.08	0.00	0	0	0
Ecuador	0.03	0.00	0	0	0
Egypt	0.07	0.00	0	0	0
Fiji	0.01	0.00	0	0	0
Ghana	0.01	0.00	0	0	0
Guatemala	0.02	0.00	0	0	0
Jordan	0.01	0.00	0	0	0
Kenya	0.01	0.00	0	0	0
Malaysia	0.11	0.00	0	0	0
Maldives	0.01	0.00	0	0	0
Mexico	0.94	0.00	0	0	0
Nigeria	0.20	0.00	0	0	0
Sri Lanka	0.01	0.00	0	0	0
Syrian Arab Republic	0.04	0.00	0	0	0
Thailand	0.10	0.00	0	0	0
Trinidad and Tobago	0.05	0.00	0	0	0
Tunisia	0.03	0.00	0	0	0
Uganda	0.01	0.00	0	0	0
Venezuela	0.57	0.00	0	0	0
Zambia	0.01	0.00	0	0	0

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arty	UN scale of contribution (%)	Percentages based on the United Nations scale with a 25 per cent ceiling (%)	Pledges for 1991 (US $)	Pledges for 1992 (US $)	Pledges for 1993 (US $)
eveloping countries that are not operating under paragraph 1 of Article 5					
ahrain	0.02	0.02	12 553	12 553	12 553
alta	0.01	0.01	6 276	6 276	6 276
anama	0.02	0.02	12 553	12 553	12 553
ingapore	0.11	0.13	69 041	69 041	69 041
nited Arab Emirates	0.19	0.22	119 253	119 253	119 253
eveloped countries					
ustralia	1.57	1.85	985 407	985 407	985 407
ustria	0.74	0.87	464 459	464 459	464 459
yelorussian SSR	0.33	0.39	207 124	207 124	207 124
anada	3.09	3.64	1 939 432	1 939 432	1 939 432
inland	0.51	0.60	320 100	320 100	320 100
erman Democratic Republic	1.28	1.51	803 389	803 389	803 389
ungary	0.21	0.25	131 806	131 806	131 806
celand	0.03	0.04	18 829	18 829	18 829
apan	11.38	13.39	7 142 633	7 142 633	7 142 633
iechtenstein	0.01	0.01	6 276	6 276	6 276
ew Zealand	0.24	0.28	150 635	150 635	150 635
orway	0.55	0.65	345 206	345 206	345 206
outh Africa	0.45	0.53	282 442	282 442	282 442
weden	1.21	1.42	759 454	759 454	759 454
witzerland	1.08	1.27	677 860	677 860	677 860
krainian SSR	1.25	1.47	784 560	784 560	784 560
SSR	9.99	11.76	6 270 202	6 270 202	6 270 202
nited States	25.00	25.00	13 333 333	13 333 333	13 333 333

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ty	UN scale of contribution (%)	Percentages based on the United Nations scale with a 25 per cent ceiling (%)	Pledges for 1991 (US $)	Pledges for 1992 (US $)	Pledges for 1993 (US $)
	0	0.00	0	0	0
(total for member States)	29.46	34.67			
gium	1.17	1.38	734 348	734 348	734 348
mark	0.69	0.81	433 077	433 077	433 077
nce	6.25	7.36	3 922 799	3 922 799	3 922 799
many, Federal Republic of	8.08	9.51	5 071 395	5 071 395	5 071 395
ece	0.40	0.47	251 059	251 059	251 059
land	0.18	0.21	112 977	112 977	112 977
ly	3.99	4.70	2 540 315	2 540 315	2 540 315
embourg	0.06	0.07	37 659	37 659	37 659
herlands	1.65	1.94	1 035 619	1 035 619	1,035 619
tugal	0.18	0.21	112 977	112 977	112 977
in	1.95	2.29	1 223 913	1 223 913	1 223 913
ted Kingdom	4.86	5.72	3 050 369	3 050 369	3 050 369
AL	92.52	100.00	53 333 333	53 333 333	53 333 333

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Appendix IV

TERMS OF REFERENCE FOR THE INTERIM MULTILATERAL FUND

A. Establishment

1. An interim Multilateral Fund, of $160 million, which could be raised by up to $80 million during the three-year period when more countries become Parties to the Protocol, hereinafter referred to as "the Multilateral Fund", shall be established.

B. Roles of the implementing agencies

2. Under the overall guidance and supervision of the Executive Committee in the discharge of its policy-making functions:

(a) Implementing agencies shall be requested by the Executive Committee, in the context of country programmes developed to facilitate compliance with the Protocol, to co-operate with and assist the Parties within their respective areas of expertise; and

(b) Implementing agencies shall be invited by the Executive Committee to develop an inter-agency agreement and specific agreements with the Executive Committee acting on behalf of the Parties.

Implementing agencies shall apply only those considerations relevant to effective and economically efficient progammes and projects which are consistent with any criteria adopted by the Parties.

3. Specifically,

(a) The United Nations Environment Programme shall be invited by the Executive Committee to co-operate and assist in political promotion of the objectives of the Protocol, as well as in research, data gathering and the clearing-house functions;

(b) The United Nations Development Programme and such other agencies which, within their areas of expertise, may be able to assist, shall be invited by the Executive Committee to co-operate and assist in feasibility and pre-investment studies and in other technical assistance measures;

(c) The World Bank shall be invited by the Executive Committee to co-operate and assist in administering and managing the programme to finance the agreed incremental costs;

(d) Other agencies, in particular regional development banks, shall also be invited by the Executive Committee to co-operate with and assist it in carrying out its functions.

4. The Executive Committee shall draw up reporting criteria and shall invite the implementing agencies to report regularly to it in accordance with those criteria.

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5. The Executive Committee shall invite the implementing agencies, in fulfilling their responsibilities in respect of the Multilateral Fund, to consult each other regularly. It shall also invite the heads of the agencies, or their representatives, to meet at least once a year to report on their activities and consult on co-operative arrangements.

6. The implementing agencies shall be entitled to receive support costs for the activities they undertake having reached specific agreements with the Executive Committee.

C. Budget and contributions

7. The Multilateral Fund shall be financed in accordance with paragraph 7 of decision II/8. In addition, contributions may be made by countries not Party to the Protocol, and by other governmental, intergovernmental, non-governmental and other sources.

8. The contributions referred to in paragraph 7 above are to be based on the scale of contributions set out in Appendix III. Bilateral, and in particular cases, regional co-operation by a country not operating under paragraph 1 of Article 5 may, according to criteria adopted by the Parties, be considered as a contribution to the Multilateral Fund up to a total of twenty per cent of the total contribution by that Party set out in Appendix III.

9. All contributions other than the value of bilateral and agreed regional co-operation referred to in paragraph 8 above shall be in convertible currency or, in certain circumstances, in kind and/or in national currency.

10. Contributions from States that become Parties not operating under paragraph 1 of Article 5 after the beginning of the financial period of the mechanism shall be calculated on a pro rata basis for the balance of the financial period.

11. Contributions not immediately required for the purposes of the Multilateral Fund shall be invested under the authority of the Executive Committee and any interest so earned shall be credited to the Multilateral Fund.

12. Budget estimates, setting out the income and expenditure of the Multilateral Fund prepared in United States dollars, shall be drawn up by the Executive Committee and submitted to the regular meetings of the Parties to the Protocol.

13. The proposed budget estimates shall be dispatched by the Fund Secretariat to all Parties to the Protocol at least sixty days before the date fixed for the opening of the regular meeting of the Parties to the Protocol at which they are to be considered.

14. After entry into force of the Amendment to the Protocol, the Financial Mechanism shall be established by the Parties at their next regular meeting and any resources remaining in the interim Multilateral Fund shall be transferred to the multilateral fund established under that mechanism.

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D. Administration

15. The World Bank shall be invited by the Executive Committee to co-operate with and assist it in administering and managing the programme to finance the agreed incremental costs of Parties operating under paragraph 1 of Article 5. Should the World Bank accept this invitation, in the context of an agreement with the Executive Committee, the President of the World Bank shall be the Administrator of this programme, which shall operate under the authority of the Executive Committee.

16. The Executive Committee shall encourage the involvement of other agencies, in particular the regional development banks, in carrying out its functions effectively in relation to the programme to finance the agreed incremental costs.

17. The Fund Secretariat operating under the Chief Officer, co-located with the United Nations Environment Programme (UNEP) at a place to be decided by the Executive Committee, shall assist the Executive Committee in the discharge of its functions. The Multilateral Fund shall cover Secretariat costs, based on regular budgets to be submitted for decision by the Executive Committee.

18. In the event that the Chief Officer of the Fund Secretariat anticipates that there may be a shortfall in resources over the financial period as a whole, he shall have discretion to adjust the budget approved by the Parties so that expenditures are at all times fully covered by contributions received.

19. No commitments shall be made in advance of the receipt of contributions, but income not spent in a budget year and unimplemented activities may be carried forward from one year to the next within the financial period.

20. At the end of each calendar year, the Chief Officer of the Fund Secretariat shall submit to the Parties accounts for the year. The Chief Officer shall also, as soon as practicable, submit the audited accounts for each period so as to coincide with the accounting procedures of the implementing agencies.

21. The Fund Secretariat and the implementing agencies shall co-operate with the Parties to provide information on funding available for relevant projects, to secure the necessary contacts and to co-ordinate, when requested by the interested Party, projects financed from other sources with activities financed under the Protocol.

22. The financing of activities or other costs, including resources channelled to third party beneficiaries, shall require the concurrence of the recipient Governments concerned. Recipient Governments shall, where appropriate, be associated with the planning of projects and programmes.

23. Nothing shall preclude a beneficiary Party operating under paragraph 1 of Article 5 from applying for its requirements for agreed incremental costs solely from the resources available to the Multilateral Fund.

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Annex V

PROVISIONAL BUDGET FOR THE MULTILATERAL FUND SECRETARIAT UNDER THE MONTREAL PROTOCOL FOR 1991

(United States dollars)

		1991
1100	Project personnel	
1101	Chief, Fund Secretarial Services 1/	90 000
1102	Deputy Chief, Fund (Economist) (P-4/P-5)	80 000
1103	Deputy Chief, clearing-house (Engineer) (P-4/P-5)	80 000
1104	Programme officer (Economist) (P-3)	70 000
1105	Programme officer (Engineer) (P-3)	70 000
1106	Programme officer (Engineer) (P-3)	70 000
1107	Programme officer (Environmental scientist) (P-3)	70 000
1108	Programme officer (Environmental scientist) (P-3)	70 000
1109	Administrative officer (P-2)	50 000
1110	Fund management officer (P-2)	50 000
SUBTOTAL		700 000
1200	Consultants	
1201	Financial mechanisms	55 000
1202	Country-specific studies	2 000 000
1203	Technology transfer and technical co-operation	1 500 000
SUBTOTAL		3 555 000

1/ For the purposes of this budget, the cost of the Chief of the Fund Secretarial Services has been calculated at the D-1 level. Should the Executive Committee wish to have the Chief at the D-2 level, the additional cost will be $10,000 each year.

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			1991
1300	Administrative support		
	1301	Senior secretary	14 000
	1302	Senior secretary	14 000
	1303	Secretary	12 000
	1304	Secretary	12 000
	1305	Secretary	12 000
	1306	Secretary	12 000
	1307	Administrative assistant	14 000
	1308	Administrative assistant	14 000
1320	Conference-servicing costs (interpreters, translators, typists, etc)		
	1320	Regional workshops (6)	500 000
SUBTOTAL			604 000
1600	Travel on official business		
	1601	Travel and subsistence costs of Secretariat staff members	25 000
	1602	Travel and subsistence costs of conference-servicing staff	25 000
SUBTOTAL			50 000
30	Training		
	3200	Training courses	
	3201	Training courses	500 000
	3300	Workshops	
	3301	Travel and subsistence costs of participants to workshops (3 each year)	465 000
SUBTOTAL			965 000

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			1991
40	Equipment		
	4100	Miscellaneous	10 000
	4202	Photocopier (2)	10 000
	4203	Personal computers (4)	32 000
	4204	Portable computers (4)	16 000
SUBTOTAL			68 000
50	Miscellaneous		
	5100	Maintenance of equipment	6 000
	5200	Reporting	10 000
SUBTOTAL			16 000
53	Sundry		
	5301	Communications	30 000
	5301	Freight charges (shipment of documents)	5 000
	5303	Other	10 000
	5304	Hospitality	3 000
SUBTOTAL			48 000
Contingency fund			600 000
TOTAL			6 606 000
Programme support costs (13%)			859 000
GRAND TOTAL			7 465 000

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Annex VI

I. REVISED BUDGET UNDER THE MONTREAL PROTOCOL FOR THE YEAR 1990
(United States dollars)

		Budget as adopted in Helsinki	Increase	Total
1100	Project personnel (to be shared between the Convention and the Protocol)			
1101	Co-ordinator (Lawyer) (P-4/P-5)	40 000	-	40 000
1102	Programme officer (Scientist) (P-3/P-4)	34 000	-	34 000
1103	Administrative officer (P-2)	23 000	-	23 000
	SUBTOTAL	97 000	-	97 000
1200	Consultants 1/			
1201	Consultants	30 000	240 000	270 000
	SUBTOTAL	30 000	240 000	270 000
1300	Administrative support			
1301	Administrative assistant (to be shared with the Convention)	6 500	-	6 500
1302	Secretary	12 000	-	12 000
	Conference-servicing costs			
1321	Second Meeting of the Parties to the Protocol	173 000	-	173 000
1322	Regional workshops (3)	-	620 000	620 000
1323	Working Group meetings (6) 2/	135 000	615 000	750 000
1324	Meetings of the Bureau	35 000	35 000	70 000
	SUBTOTAL	361 500	1 270 000	1 631 500

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		Budget as adopted in Helsinki	Increase	Total
1600	Travel on official business			
	1600 Travel and subsistence costs of UNEP staff members	60 000	30 000	90 000
	SUBTOTAL	60 000	30 000	90 000
3300	Meeting/conferences			
	Travel and subsistence cost of experts from developing countries to participate in the:			
	3301 Second Meeting of the Parties (1990)	35 000	165 000	200 000
	3302 Regional workshops	-	70 000	70 000
	3303 Working group meetings (6)	105 000	240 000	345 000
	3304 Travel and daily subsistence allowance of participants of the Bureau	35 000	-	35 000
	SUBTOTAL	175 000	475 000	650 000
4000	Equipment	20 000	-	20 000
	SUBTOTAL	20 000	-	20 000

		Budget as adopted in Helsinki	Increase	Total
5000 Miscellaneous				
5100	Maintenance of equipment	3 000		3 000
5200	Reporting costs 3/	5 000	172 000	177 000
SUBTOTAL		8 000	172 000	180 000
5300 Sundry				
5301	Communications	10 000	10 000	20 000
5302	Freight charges (shipment of documents)	7 000	8 000	15 000
5303	Other	5 000	5 000	10 000
5400	Hospitality	10 000	15 000	25 000
SUBTOTAL		32 000	38 000	70 000
TOTAL		783 500	2 225 000	3 008 500
Programme support costs (13%)		100 000	291 500	391 500
GRAND TOTAL		883 500	2 516 500	3 400 000

1/ Consultants for preparing a data base on the controlled substances, studies on financial mechanisms, country studies and preparations for the Second Meeting of the Parties.

2/ Based on the experience in 1989, the total conference-servicing costs of a Working Group meeting of 4-5 days are estimated at approximately $20,000 per working language and approximately $5,000 for secretarial support. Thus, a Working Group meeting using three working languages would cost approximately $65,000. The cost will vary depending on the level of daily subsistence allowance applicable at the venue of the meeting. For the purpose of this budget, Geneva has been taken as the venue.

3/ Including translation, reproduction and dissemination of the executive summaries of the assessment panel reports, the synthesis report, the report of the Technology Review Panel and the five technical options reports.

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II. TRUST FUND FOR THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

Contribution to the costs of Ozone Secretariat for 1990 (expressed in US dollars)

	A Trust Fund pledges for 1990 a (US $)	B Additional funds requested b/ (US $)	C Percentage of total costs c/ (%)	D Adjusted additional pledge for 1990 ($133,656 x C)	E Total adjusted pledges (A + B + D) (US $)	F Paid for 1990 (as at 15 June 1990) (US $)	G Balance to be paid (E - F) (US $)
alia	16 108	39 721	1.70	2 272	58 101	0	58 101
ia	7 592	18 722	0.80	1 071	27 385	0	27 385
n	0	0	0.00	0	0	0	0
um	12 000	29 920	1.27	1 693	43 613	0	43 613
l	11 158	27 514	1.57	2 099	40 771	0	40 771
na Faso	0	0	0.00	0	0	0	0
russian SSR	3 385	8 360	0.36	478	12 223	0	12 223
oon	0	0	0.00	0	0	0	0
a	31 694	78 980	3.35	4 472	115 146	31 694	83 452
	0	0	0.00	0	0	0	0
rk	7 077	17 600	0.75	999	25 676	7 077 d/	18 599
or	0	0	0.00	0	0	0	0
	0	0	0.00	0	0	0	0
	0	0	0.00	0	0	0	0
nd	5 231	12 980	0.55	738	18 949	18 211	738
e	64 105	159 720	6.77	9 046	232 871	0	232 871
n Democratic ublic	14 257	35 420	1.39	1 853	51 530	14 257	37 273
ny, Federal ublic of	82 875	206 360	8.75	11 695	300 930	82 875	218 055
	0	0	0.00	0	0	0	0
e	4 103	10 120	0.43	579	14 802	0	14 302
mala	0	0	0.00	0	0	0	0
ry	2 154	5 280	0.23	304	7 738	7 434	304

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arty	A Trust Fund pledges for 1990 a/ (US $)	B Additional funds requested b/ (US $)	C Percentage of total costs c/ (%)	D Adjusted additional pledge for 1990 ($133,656 x C)	E Total adjusted pledges (A + B + D) (US $)	F Paid for 1990 (as at 15 June 1990) (US $)	G Balance to be paid (E - F) (US $)
eland	0	0	0.00	0	0	0	0
eland	1 846	4 620	0.19	261	6 727	6 466	261
aly	40 925	101 860	4.32	5 755	148 560	0	148 560
apan	116 722	290 620	12.32	16 471	423 813	0	423 813
rdan	0	0	0.00	0	0	0	0
nya	0	0	0.00	0	0	0	0
echtenstein	0	0	0.00	0	0	0	0
xembourg	0	0	0.00	0	0	0	0
laysia	1 129	2 783	0.12	159	4 071	0	4 071
ldives	0	0	0.00	0	0	1 500	(1 500)
lta	0	0	0.00	0	0	0	0
xico	9 641	23 980	1.02	1 361	34 982	0	34 982
therlands	16 924	42 240	1.79	2 388	61 552	0	61 552
w Zealand	2 462	6 160	0.26	347	8 969	8 622	347
geria	2 051	5 060	0.22	289	7 400	0	7 400
rway	5 641	17 124	0.60	796	23 561	19 721 e/	3 840
nama	0	0	0.00	0	0	0	0
rtugal	1 846	4 620	0.19	261	6 727	0	6 727
ngapore	1 128	2 860	0.12	159	4 147	1 128	3 019
uth Africa	4 617	11 385	0.49	651	16 653	0	16 653
ain	20 001	49 720	2.11	2 822	72 543	0	72 543
i Lanka	0	0	0.00	0	0	0	0
eden	12 411	60 000	1.31	1 751	74 162	25 911	48 251
itzerland	11 077	27 500	1.17	1 563	40 140	27 500	12 640
rian Arab Republic	0	0	0.00	0	0	0	0
ailand	1 026	2 530	0.11	145	3 701	0	3 701
indad and Tobago	0	0	0.00	0	0	0	0
nisia	0	0	0.00	0	0	0	0

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Party	A Trust Fund pledges for 1990 a/ (US $)	B Additional funds requested b/ (US $)	C Percentage of total costs c/ (%)	D Adjusted additional pledge for 1990 ($133,656 x C)	E Total adjusted pledges (A + B + D) (US $)	F Paid for 1990 (as at 15 June 1990) (US $)	G Balance to be paid (E - F) (US $)
Uganda	0	0	0.00	0	0	0	0
Ukrainian SSR	12 821	31 900	1.35	1 809	46 530	0	46 530
USSR	102 465	255 200	10.82	14 459	372 124	0	372 124
United Arab Emirates	1 949	4 807	0.21	275	7 031	0	7 031
United Kingdom	49 848	124 080	5.26	7 034	180 962	49 848	131 114
USA	220 875	550 000	25.00	33 414	804 289	70 750	733 539
Venezuela	5 846	14 520	0.62	825	21 191	0	21 191
Zambia	0	0	0.00	0	0	0	0
EEC	22 088	55 000	2.50	3 341	80 429	22 088	58 341
TOTAL	927 078	2 339 266	100.00	133 656	3 400 000	395 082	3 004 918

a/ Level of contributions calculated on the basis of the scale of assessments agreed by the First Meeting of the Contracting Parties in May 1989, Helsinki.

b/ The additional funds requested by the Open-Ended Working Group at the third session of its first meeting, 18-22 September, 1989.

c/ Calculated on the basis of the United Nations scale of assessments, as agreed by the First Meeting of the Parties.

d/ $100,000 paid for support to participants from developing countries and studies on technology options in low income developing countries is removed from the table, as it is considered as special additional contribution.

e/ $3,044 paid for support to participants from developing countries is removed from the table, as it is considered as special additional contribution.

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III. BUDGET FOR THE SECRETARIAT CORE COSTS UNDER THE MONTREAL PROTOCOL FOR 1991 AND 1992

(United States dollars)

		1991	1992	Total
1100	Project personnel			
1101	Secretary (Co-ordinator)(D-1)	90 000	92 000	182 000
1102	Deputy Secretary (Lawyer)(P-4/P-5) (shared with the Vienna Convention)	40 000	41 000	81 000
1103	Programme officer (Lawyer) (P-3)	70 000	72 000	142 000
1104	Programme officer (Chemist/ environmental scientist)(shared with the Vienna Convention) (P-3)	35 000	36 000	71 000
1105	Administrative officer (shared with the Vienna Convention) (P-2)	25 000	26 000	51 000
SUBTOTAL		260 000	267 000	527 000
1200	Consultants			
1201	Data reporting	30 000	30 000	60 000
1202	Preparations for the Meeting of the Parties	10 000	10 000	20 000
1203	Dissemination of information	10 000	10 000	20 000
SUBTOTAL		50 000	50 000	100 000
1300	Administrative support			
1301	Administrative assistant (shared with the Vienna Convention)	7 000	7 000	14 000
1302	Senior secretary	14 000	14 000	28 000
1303	Secretary 1/	12 000	6 000	18 000
1304	Secretary 1/	12 000	6 000	18 000

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	1991	1992	Total
1320 Conference-servicing costs (interpreters, translators, typists, etc)			
1321 Third Meeting of the Parties to the Montreal Protocol	175 000	-	175 000
1322 Fourth Meeting of the Parties to the Montreal Protocol	-	175 000	175 000
1323 Working Group meetings (6)	480 000	240 000	720 000
1324 Meeting of the Bureau of the Montreal Protocol (4)	70 000	70 000	140 000
1325 Informal consultations (4)	10 000	10 000	20 000
1326 Meeting of the assessment panels	10 000	50 000	60 000
1327 Meetings of committees established by the Parties 2/	100 000	145 000	245 000
SUBTOTAL	890 000	723 000	1 613 000
1600 Travel on official business			
1601 Travel and subsistence costs of Secretariat staff members	100 000	100 000	200 000
1602 Travel and subsistence costs of UNEP conference-servicing staff	40 000	20 000	60 000
SUBTOTAL	140 000	120 000	260 000
3300 Meetings/conferences			
3301 Travel and subsistence costs of participants in the Working Group meetings (15 participants from developing countries per meeting, $3,500 per participant)	210 000	105 000	315 000
3302 Travel and subsistence costs of participants in the Meetings of the Parties (30 participants from developing countries)	100 000	100 000	200 000
3303 Travel and subsistence costs of participants from developing countries in the meetings of the Bureau	35 000	35 000	70 000

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		1991	1992	Total
3304	Travel and subsistence costs of participants from developing countries in assessment meetings	35 000	175 000	210 000
3305	Travel and subsistence costs of participants from developing countries in committee meetings	70 000	70 000	140 000
SUBTOTAL		450 000	485 000	935 000
4000 Equipment				
4100	Miscellaneous	5 000	10 000	15 000
4201	Telefax machine	5 000	-	5 000
4202	Photocopier (1)	5 000	-	5 000
4203	Personal computers (3)	24 000	-	24 000
4204	Portable computers (3)	12 000	-	12 000
SUBTOTAL		51 000	10 000	61 000
5000 Miscellaneous				
5100	Maintenance of equipment	3 000	9 000	12 000
5200	Reporting	30 000	35 000	65 000
SUBTOTAL		33 000	44 000	77 000
5300 Sundry				
5301	Communications	30 000	30 000	60 000
5301	Freight charges (shipment of documents)	15 000	15 000	30 000
5303	Other	10 000	10 000	20 000
5401	Hospitality	15 000	15 000	30 000
SUBTOTAL		70 000	70 000	140 000
Contingency Fund		200 000	200 000	400 000
TOTAL		2 144 000	1 969 000	4 113 000
Programme support costs (13%)		279 000	256 000	535 000
GRAND TOTAL		2 423 000	2 225 000	4 648 000

1/ To be shared with the Vienna Convention from 1992, when a new budget is adopted for the Convention.

2/ The estimated cost per meeting (of 2-3 days) using three languages is approximately $11,000 per language. Three meetings are anticipated in 1991. Four meetings are anticipated in 1992 at a cost of approximately $12,000 per language.

IV. TRUST FUND FOR THE MONTREAL PROTOCOL ON SUBSTANCES THAT DEPLETE THE OZONE LAYER

Contributions to the core costs of the Ozone Secretariat for 1991-1992

Party	Percentage of total costs*	Pledges for 1991 ($)	Pledges for 1992 ($)
Australia	1.70	41 195	37 828
Austria	0.80	19 417	17 830
Bahrain	0.00	0	0
Belgium	1.27	30 699	28 191
Brazil	1.57	38 046	34 937
Burkina Faso	0.00	0	0
Byelorussian SSR	0.36	8 659	7 951
Cameroon	0.00	0	0
Canada	3.35	81 077	74 452
Chile	0.00	0	0
Denmark	0.75	18 105	16 625
Ecuador	0.00	0	0
Egypt	0.00	0	0
Fiji	0.00	0	0
Finland	0.55	13 382	12 288
France	6.77	163 991	150 590
German Democratic Republic	1.39	33 585	30 841
Germany, Federal Republic of	8.75	212 008	194 683
Ghana	0.00	0	0
Greece	0.43	10 495	9 638
Guatemala	0.00	0	0
Hungary	0.23	5 510	5 060
Iceland	0.00	0	0
Ireland	0.19	4 723	4 337
Italy	4.32	104 692	96 137
Japan	12.32	298 595	274 195
Jordan	0.00	0	0
Kenya	0.00	0	0
Liechtenstein	0.00	0	0
Luxembourg	0.00	0	0
Malaysia	0.12	2 886	2 650
Maldives	0.00	0	0
Malta	0.00	0	0
Mexico	1.02	24 664	22 649
Netherlands	1.79	43 294	39 756
New Zealand	0.26	6 297	5 783
Nigeria	0.22	5 248	4 819
Norway	0.60	14 431	13 252
Panama	0.00	0	0

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Party	Percentage of total costs*	Pledges for 1991 ($)	Pledges for 1992 ($)
Portugal	0.19	4 723	4 337
Singapore	0.12	2 886	2 650
South Africa	0.49	11 807	10 843
Spain	2.11	51 165	46 984
Sri Lanka	0.00	0	0
Sweden	1.31	31 749	29 154
Switzerland	1.17	28 338	26 022
Syrian Arab Republic	0.00	0	0
Thailand	0.11	2 624	2 409
Trinidad and Tobago	0.00	0	0
Tunisia	0.00	0	0
Uganda	0.00	0	0
Ukrainian SSR	1.35	32 798	30 118
USSR	10.82	262 124	240 704
United Arab Emirates	0.21	4 985	4 578
United Kingdom	5.26	127 520	117 099
United States of America	25.00	605 750	556 250
Venezuela	0.62	14 956	13 734
Zambia	0.00	0	0
EEC	2.50	60 575	55 625
TOTAL	100.00	2 423 000	2 225 000

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* Calculated on the basis of the United Nations scale of assessments, as agreed by the First Meeting of the Parties.

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Annex VII

RESOLUTION BY THE GOVERNMENTS AND THE EUROPEAN COMMUNITIES REPRESENTED AT THE SECOND MEETING OF THE PARTIES TO THE MONTREAL PROTOCOL

The Governments and the European Communities represented at the Second Meeting of the Parties to the Montreal Protocol

Resolve:

I. Other halons not listed in Annex A, Group II, of the Montreal Protocol ("Other halons")

1. To refrain from authorizing or to prohibit production and consumption of fully halogenated compounds containing one, two or three carbon atoms and at least one atom each of bromine and fluorine,* and not listed in Group II of Annex A of the Montreal Protocol (hereafter called "other halons"), which are of such a chemical nature or such a quantity that they would pose a threat to the ozone layer;

2. To refrain from using other halons except for those essential applications where other more environmentally suitable alternative substances or technologies are not yet available; and

3. To report to the Secretariat to the Protocol estimates of their annual production and consumption of such other halons;

II. Transitional substances

1. To apply the following guidelines to facilitate the adoption of transitional substances with a low ozone-depleting potential, such as hydrochlorofluorocarbons (HCFCs), where necessary, and their timely substitution by non-ozone depleting and more environmentally suitable alternative substances or technologies:

(a) Use of transitional substances should be limited to those applications where other more environmentally suitable alternative substances or technologies are not available;

(b) Use of transitional substances should not be outside the areas of application currently met by the controlled and transitional substances, except in rare cases for the protection of human life or human health;

(c) Transitional substances should be selected in a manner that minimizes ozone depletion, in addition to meeting other environmental, safety and economic considerations;

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* (Reference is made to the list of other halons that will appear in the Montreal Protocol Handbook to be prepared by the Executive Director.)

(d) Emission control systems, recovery and recycling should, to the degree possible, be employed in order to minimize emissions to the atmosphere;

(e) Transitional substances should, to the degree possible, be collected and prudently destroyed at the end of their final use;

2. To review regularly the use of transitional substances, their contribution to ozone depletion and global warming, and the availability of alternative products and application technologies, with a view to their replacement by non-ozone depleting and more environmentally suitable alternatives and as the scientific evidence requires: at present, this should be no later than 2040 and, if possible, no later than 2020;

III. 1,1,1-trichloroethane (methyl chloroform)

1. To phase out production and consumption of methyl chloroform as soon as possible;

2. To request the Technology Review Panel to investigate the earliest technically feasible dates for reductions and total phase out; and

3. To request the Technology Review Panel to report their findings to the preparatory meeting of the Parties with a view to the consideration by the Meeting of the Parties, not later than 1992;

IV. More stringent measures

1. To express appreciation to those Parties that have already taken measures more stringent and broader in scope than those required by the Protocol;

2. To urge adoption, in accordance with the spirit of paragraph 11 of Article 2 of the Protocol, of such measures in order to protect the ozone layer.

Q: The mechanism for funding Article 5 countries' participation in the Protocol will be based on "agreed incremental costs." Can you elaborate more specifically on what is meant by this term? What methodologies will be used to determine "incremental costs"?

A: IN RESPONSE TO YOUR QUESTION ON "INCREMENTAL COST," I ENCLOSE A COPY OF A UNEP REPORT WHICH IS ILLUSTRATIVE OF THESE KINDS OF COSTS. I BELIEVE THIS WILL BE HELPFUL IN UNDERSTANDING THIS CONCEPT.

Q: The U.S. currently spends far more money on both understanding and monitoring the ozone layer than most other countries. Is there likely to be a shift in this burden in the foreseeable future? Over the long term?

A: WHILE IT IS TRUE THAT THE U.S. CURRENTLY SPENDS MORE THAN OTHER COUNTRIES ON RESEARCH ON THE OZONE LAYER, WE EXPECT OTHERS TO DO INCREASINGLY MORE IN THIS AREA IN THE NOT-TOO-DISTANT FUTURE. WE AGREE THAT THE BURDEN OUGHT TO SHIFT IN THIS RESPECT, AND WILL MAKE THIS POINT IN APPROPRIATE INTERNATIONAL FORA.

The ROVAC Corporation
P.O. Box 111 1030 Stafford Street
Rochdale, Massachusetts 01542 • 508/892-4841

October 3, 1990

Rep. Claudine Schneider
House Committee on Science, Space and Technology
Room 388 - House Annex #2
Washington, DC 20515

Dear Representative Schneider:

In regard to the Committee's recent hearings on CFC/Ozone Depletion, as related to the Montreal Protocol, we appreciate the coverage given to The ROVAC Corporations's ozone-protective, automotive air-conditioning system. As you know, this is the same air-conditioning unit which we demonstrated to you last December in Providence, RI.

As part of the record on these hearings, it will be most helpful if ROVAC'S patented CRV (Constrained Rotary Vane) technology can be mentioned in the Committee's final report. Thus, enclosed is data on this technology which we believe will prove pertinent. Included are two product briefs on the ROVAC environmentally-safe, automotive air conditioning system, as well as a fact sheet on the Corporation. This provides significant background covering the Company, its product developments and key personnel.

We do want to extend our sincere thanks for your continued interest . . . and if we can furnish additional information, we will look forward to hearing from you, or a member of your staff.

Very truly yours,

Raymond E. Shea, Jr.

Raymond E. Shea, Jr.
Vice President

Florida: Product Design Office 1426 Gleneagles Way • Rockledge, Florida 32955

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(10/10/89)

THE ROVAC CORPORATION

CORPORATE FACT SHEET

The ROVAC Corporation, headquartered in Rochdale, Massachusetts, is a developer of environmentally-safe air conditioning, heating, and small-scale electric power generating technology.

ROVAC: SUPPLYING TECHNOLOGICAL SOLUTIONS TO OZONE DEPLETION

Because of rapidly-increasing concerns over the critical depletion of the planet's ozone layer, ROVAC finds itself uniquely positioned to play a key role in providing immediate, cost-effective solutions to this growing ecological crisis.

Problem:

Since the 1930's, CFC (chlorofluorocarbon) refrigerants have been the standard cooling solutions used in automotive, residential, as well as commercial air-conditioning and refrigeration systems.

Unfortunately, these coolants have leaked from traditional high-pressure cooling equipment in such destructive quantities that they have torn gaps in the ozone layer--the protective atmospheric shield which screens the Earth from harmful, intense ultraviolet rays generated by the sun.

Released CFCs are very stable, and can remain in the atmosphere for decades. When CFCs reach the stratosphere (10-20 miles above the earth), their molecular structure breaks apart and releases chlorine gas--a single atom of which can destroy 100,000 protective ozone molecules.

The increased ultraviolet radiation pouring through the weakening ozone shield has resulted in greater incidences of skin cancer, cataracts, and damages to the human immune system and marine food chains--as well as contributed to the general warming of the planet.

Alarmingly, today, one-third of all CFC pollutants in our stratosphere leak from motor vehicle air-conditioning systems. The emission of only one ounce of these harmful refrigerants will destroy many tons of protective ozone.

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Action:

Worldwide pressures are mounting to find a solution:

--Most of the world's nations have agreed to phase out CFC production by early in the 21st century;

--Vermont has banned the sale of new cars using CFC air conditioning systems starting in 1993;

--Senator Albert Gore, D-Tenn., has introduced Federal legislation that would phase out all chemicals contributing to ozone depletion, impose an excise tax on manufacturing such substances, and create a trust to fund the search for substitutes;

--Senator John Kerry, D-Mass., has filed a Federal bill to limit CFC-based motor vehicle air conditioning;

--The City of Irvine, CA, has passed an ordinance banning the use of CFC's beginning in 1991;

--The State of California may soon follow with a similar ban slated for 1991;

--Many other states and municipalities are also preparing anti-CFC legislation--as are a host of other nations.

In the face of these bans, Detroit and other carmakers are encountering a serious business problem--over 75 percent of new automobiles sold are equipped with CFC-based air conditioners.

Thus, ROVAC's new air-conditioner technology offers the answer, today--to everybody's benefit.

Solution:

ROVAC--The Technological Answer

The patented ROVAC rotary-vaned, low-pressure gas compressor uses no dangerous CFC refrigerants.

This revolutionary technology has led the U.S. Department of Energy (DOE) to award The ROVAC Corporation a grant to develop and test highly-efficient, ozone-protective air conditioning systems, based on environmentally-safe refrigerants. Testing in vehicular wind tunnels has proven that the ROVAC-developed units meet or exceed the performance of traditional CFC-based motor vehicle air-conditioning systems.

At the EPA-sponsored "International CFC and Halons Alternatives Conference" to be held in Washington, D.C. on October 10 and 11, 1989, the Company will demonstrate two

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test vehicles--which are fully air-conditioned by the ROVAC-based systems--to the media, as well as government and industry leaders and environmental researchers.

When installed as original equipment or retrofits in automobiles and heavy vehicles, these ROVAC-based AC units can have an immediate, beneficial impact toward saving the world's fragile environment.

ROVAC's RESPONSE TO SAFE ENERGY PRODUCTION CHALLENGES

Of equal significance is today's furor over the role of nuclear power in solving the world's looming energy shortage, and worries over the "greenhouse effect" caused by the combustion of fossil fuels. Here, too, ROVAC technology supports a viable alternative.

Atomic Energy of Canada Limited (AECL), a private energy research corporation created by the Canadian government, has funded The ROVAC Corporation's pilot development of small-scale companion generators--in effect, literally: "backyard power plants." Single, stand alone units may soon be able to generate up to 200 kilowatts of electricity from the hot water produced by AECL's "SLOWPOKE"--a new generation of safe, miniature nuclear reactors.

Moreover, energy conservation and efficiency needs also play to the Company's technology and product development strengths. ROVAC has developed and tested prototypes for efficient gas-fired heat pumps. The Company believes that there is a multi-billion-dollar worldwide market for this type of natural-gas heating and cooling equipment.

HISTORY

The ROVAC Corporation was founded in Rockledge, Florida, by a university researcher, Dr. Thomas Edwards, in 1972, and incorporated in 1974.

Dr. Edwards studied and presented plans for this revolutionary new low-friction, rotary expander/compressor technology in his doctoral thesis, submitted to Purdue University's School of Mechanical Engineering in 1970. Soon, thereafter, he created a company to develop his theories into practical reality.

From 1974 to 1983, ROVAC spent over $8 million in technology development and worldwide patent-seeking. Unfortunately, over this period, the Company was unable to introduce any commercial products. As a result, by 1984, The ROVAC Corporation was on the ropes, hindered by its lack of funds from carrying out further product or market development.

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However, no one who had examined the revolutionary ROVAC technology could doubt its potential market impact on automotive and structural air conditioning, heat pump design, and small-scale electric power generation.

One firm which favorably evaluated ROVAC's basic premise was Stafford Industries of Rochdale, MA. Stafford's entrepreneurial managers--Raymond Shea, Sr., Raymond Shea, Jr., and Jack Ferris--saw that the ROVAC rotary compressor could be beneficially and profitably applied to very specific markets, once the Company's financial house was placed in order.

From May, 1984, until August, 1985, Stafford directed The ROVAC Corporation through a Chapter 11 reorganization, in order to liquidate debts, satisfy claims and discharge lawsuits. ROVAC is now returning to operation and is actively developing and demonstrating its unique technology in a variety of applications. The Company has issued two major licenses for off-road vehicle air conditioners and electric-power production.

APPLICATIONS FOR ROVAC TECHNOLOGY

The recent tremendous outburst of media and public concern over CFC pollution, ozone layer depletion, and the critical effects of global warming has already set up The ROVAC Corporation as a potential technological and ecological champion.

Having cleared the Chapter 11 process, the new management has embarked on several highly-focused feasibility studies, pilot projects and prototypes in areas which they feel will result in large-volume, profitable commercial products:

--Highly-efficient, automotive and heavy-duty vehicle air conditioning systems

--Residential and Commercial heat pumps

MARKETING STRATEGY

In the entrepreneurial mold, ROVAC management plans to continue promoting and securing developmental grants, joint ventures, and licensing agreements leading to commercial market introduction of systems based on the Company's technology, components and products. It is also developing plans for production in major fields of use.

To further the development of commercial products based on this technology, the Company feels it must sell to:

--Automakers and vehicle manufacturers (automotive air conditioning);

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--Automotive aftermarket product sellers/installers;

--Heavy-duty and off-road vehicle manufacturers;

--HVAC system manufacturers (heat pumps, building/home heating and cooling);

--Energy conservation system specifiers.

In addition, management believes that to create public awareness of the solutions it can provide, it must favorably influence the following parties:

--Environmental proponents

--Nuclear power advocates

--Federal/state lawmakers

--Government regulatory agencies

--Government lobbyists (target industries)

--Industry associations

--Research organizations

However, like any small company, The ROVAC Corporation faces many obstacles in its efforts to provide a solution--most thrown up by rival companies with a vested interest in current equipment and technology.

LET THE COOLANT WARS BEGIN

The worldwide giants of the chemical industry, which have an enormous investment in the production of CFC-based coolants, are faced with a major dilemma. They must scramble to develop and mass-produce non-polluting CFC substitutes, while stalling the progress of anti-CFC legislation in an effort to buy more research time, and preserve their enormous, worldwide CFC markets.

Du Pont, ICI, and other large chemical firms are now mounting their own extensive, well-financed lobbying efforts for FC-134a, the non-CFC alternative refrigerant they have chosen for development. However, this coolant blend is riddled with problems and shortcomings, and will not be ready as a volume CFC substitute for many years.

The FC-134a refrigerant is from 5-to-10 times more expensive than currently-used coolants. In auto air conditioning systems, it is less efficient in its cooling--so that it consumes from 8-to-10 percent more energy, thus increasing vehicle gasoline consumption and resulting carbon dioxide (CO 2) exhaust emissions. Beside the added energy costs,

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scientists estimate that every extra gallon of gasoline burned creates up to 10 pounds of CO 2 output, which is the major factor contributing to the global "greenhouse effect". In any case, ROVAC is now developing an efficient compressor for the application of this potential refrigerant.

In addition, FC-134a has an unsolved lubrication problem, which will require development and testing of new compressor designs. The coolant is unstable and may be toxic--possibilities which can only be proven through years of toxicity testing.

In contrast, the ROVAC CRV compressor uses a number of commercially available, non-toxic, ozone-safe refrigerants, which are fully compatible with present refrigerant oils. They also provide excellent heat-transfer properties and thermodynamic efficiencies.

In addition to these refrigerants, other options are available to ROVAC. Hydrocarbons--such as those used in modern, environmentally-safe spray cans, for example--are also inexpensive and immediately available, worldwide, as CFC coolant substitutes. Since the ROVAC CRV compressor moves this coolant blend at far-lower operating pressures, there is virtually no leakage. In fact, most cars equipped with ROVAC-based systems would never need their AC systems recharged.

Demonstration automobiles fitted with ROVAC auto AC systems have been tested in professional vehicular wind tunnels. These systems have been found to meet and exceed the vehicle cooling performance of today's conventional CFC-based systems.

Regardless of which refrigerant(s) eventually prove to be the new industry standard, ROVAC will have a compressor technology available, even if it proves to be FC-134a.

CHRONOLOGY

Milestones in the Progressive Destruction of the Earth's Protective Ozone Layer by CFC Pollutants:

Eons past	Stratospheric ozone shield develops, nurturing development of early life forms.
1835	First commercial use of mechanical refrigeration for ice production.
1930's-Present	CFC's first developed as refrigerants in mechanical refrigeration systems--gradually replace earlier coolants.
1974	First publication of theory linking CFCs to ozone destruction.

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1975	First demonstration of motor vehicle air conditioner with no CFC refrigerants by ROVAC.
1976-1979	Prototype of above system demonstrated to several U.S. automakers.
1978	The U.S. and several foreign countries ban the use of CFCs in "non-essential" applications (aerosol spray cans, other products.)
1981	Non-CFC, low-pressure, hydrocarbon-based auto air conditioner demonstrated by ROVAC to a major Japanese carmaker.
1986	Results of atmospheric studies confirm theory of CFCs' destruction of ozone layer.
1986	CBS EVENING NEWS' Jane Bryant-Quinn covers ROVAC's CFC alternative technology.
1987	The Montreal Accords: World leaders agree to limit production/usage of CFCs.
1987	Scientists discover "holes" in stratospheric ozone layer.
1988	ROVAC demonstrates its ozone-protective automotive air conditioner (test-bench unit) at International CFC Alternatives Conference in Washington, D.C.
1988	CFC manufacturers announce (via press release) intention to develop inefficient, costly and questionable FC-134a refrigerant as CFC alternative.
1988	U.S. Department of Energy awards grant to ROVAC for development of non-polluting, ozone-protective auto air conditioner.
1989	Vehicular wind tunnel tests prove high operating performance of ROVAC's low-pressure, ecologically-safe, auto air conditioner.
1989	Anti-CFC legislation and media coverage builds (Vermont ban on CFC-based auto AC systems; proposed California ban; various Federal bills introduced in Congress; City of Irvine, CA, ban; numerous articles and interviews).

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1989	Two cars equipped with ozone-protective air conditioning systems demonstrated by The ROVAC Corporation at the EPA's International CFC and Halons Alternatives Conference in Washington, D.C.

FINANCIAL SUMMARY

During the past year, Stafford Industries, Inc., ROVAC's largest shareholder, returned 2.5 million shares of ROVAC common stock (NASD Symbol: RVAC) to the Company's treasury. In addition, the shareholders of ROVAC authorized 25,000 shares of preferred stock, which management intends to use in exchange for ROVAC's debt to Stafford Industries, Inc.

Stafford Industries, Inc., has also agreed to transfer a parcel of real estate to The ROVAC Corporation. This consists of properties containing approximately 145,000 square feet of income-producing commercial floor space and nine acres of land, which were, together, appraised for $3,263,000 in October, 1988. In exchange, ROVAC has arranged financing to liquidate Stafford's $800,000 loan on the property to be transferred.

These financial actions greatly improve the Company's ability to survive and grow. First, Stafford's return of shares of stock to the Company's treasury immediately decreased the amount of ROVAC common stock issued and outstanding by 2.5 million shares. Under conditions favorable to the Company, these shares can be sold to further enhance ROVAC's financial position. Second, by acquiring the income-producing real estate properties of Stafford, ROVAC obtains valuable real estate as well as some $325,000 in annual revenues from the established rental income base.

Finally, through a plan aimed at issuing preferred stock to Stafford by ROVAC, more than $1.1 million of debt will be eliminated.

MANAGEMENT PROFILES

Raymond E. Shea, Sr.
Chairman of the Board, Chief Executive Officer

An officer and board member of The ROVAC Corporation since 1984, Mr. Shea is a successful inventor and an entrepreneur who has commercialized other technical products, and turned around several struggling businesses. Since 1983, Raymond Shea has also been President of U.S. Fire Control Corporation, as well as President and CEO of Stafford Industries, Inc.

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Dr. Thomas C. Edwards
Director/ROVAC Product Design Office, Rockledge, Florida

Founder and former President of The ROVAC Corporation, Dr. Edwards is the inventor of the ROVAC CRV compressor and has been a board member since the Company's formation in 1972. Subsequently, he has served in a variety of posts, including Board Chairman, Chief Engineer, as well as CEO, and now is Director of ROVAC's Product Design Office in Florida. Dr. Edwards received his Ph.D. from Purdue University's School of Mechanical Engineering in 1970.

Raymond E. Shea, Jr.
Treasurer

A ROVAC corporate officer since 1985, Mr. Shea has served in several key operating positions. Since 1984, he has also been Treasurer and Director of Stafford Industries, Inc. Prior to that post, he worked with the Central Water District Corporation.

Robert Reisner
Secretary and Director

A financial consultant and workout specialist, Mr. Reisner supervises various corporate transactions and re-organizations. Since April, 1983, he has been associated with A.E. Getzler Inc., a firm of management and workout specialists. Prior to that, he was CFO and Director of General Hobbies, Inc., while it was involved in Chapter 11 proceedings. From 1977-79, Mr. Reisner was President and COO of Valley Fair Corporation, where he served as a workout specialist during its Chapter 11 proceedings.

John S. Loscocco
Director

Mr. Loscocco is President of Acquivest Group, Inc., a ventures-management development company, where he has served for more than the past five years. He is also President of Seatrain Lines, Inc.

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NASA
National Aeronautics and
Space Administration
Washington, D.C.
20546

OCT 11 1990

Reply to Attn of L:MDD:L90-2014F

Honorable James H. Scheuer
Chairman
Subcommittee on Natural Resources,
Agriculture Research and Environment
Committee on Science, Space
and Technology
House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

Enclosed are the responses to written questions submitted jointly with Chrm. Ralph Hall resulting from the July 11, 1990, hearing at which Dr. Watson testified concerning the results of the London Meeting of the Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer.

This material completes the information requested during that hearing.

Sincerely,

Mary D. Kerwin
Director, Congressional Liaison Division

Enclosure

cc:
Honorable Ralph M. Hall

Responses to written questions submitted by Cong. Hall and Cong. Scheuer resulting from the July 11, 1990, hearing.

QUESTION 1:

Paragraph 22 of the United Nation Environmental Programme (UNEP) report of the Second Meeting of the Parties to the Montreal Protocol calls for improved monitoring of ozone depletion. Would you describe the international cooperative efforts now in place to improve the monitoring network?

ANSWER 1:

In recent years we have made great strides in the accuracy and precision of our stratospheric ozone measurements. Current activities focus on making further improvements to this network of observations.

The international Dobson network, coordinated by the World Meteorological Organization (WMO), is currently the primary ground-based means for measuring total column ozone. Many nations are attempting to improve the calibration of this network. In addition, Dobson measurements are complemented by an expanding network of related instruments in the USSR, Canada, and other nations. Key satellite instruments for measuring total column ozone include the National Oceanic and Atmospheric Administration (NOAA) Solar Backscatter Ultraviolet/Version-2 (SBUV/2) sensor which flies on the operational meteorological satellites and also on the Space Shuttle (SSBUV) for calibration purposes. In addition, the Total Ozone Mapping Spectrometer (TOMS) on the NOAA Nimbus-7 satellite provides critical observations of global ozone concentration. Future TOMS flights are planned for a Soviet Meteor-3 satellite (1991), a U.S. Scout-class spacecraft (1993), and the Japanese Advanced Earth Observing Satellite (ADEOS) (1995).

The international Umkehr system is the primary source for measurements of the vertical distribution of ozone. The capabilities of the system are being improved through the use of upgraded instruments, coupled with simultaneous measurements of aerosols (which will improve the quality of the derived ozone distributions). The NOAA SBUV/2 instruments contribute to this data set, along with observations by the NASA Stratospheric Aerosol and Gas Experiment II (SAGE II) instrument flown on the Earth Radiation Budget Experiment (ERBE) satellite. In the future, instruments on the Upper Atmosphere Research Satellite (UARS), set for launch in 1991, and the Earth Observing System (EOS) will provide vastly improved measurements of vertical ozone distribution.

The International Network for the Detection of Stratospheric Change (NDSC) is in its initial implementation phase. This network will monitor a large number of key stratospheric constituents (total column or vertical distribution). To date scientists from ten countries have indicated they will participate in the NDSC. The instruments on UARS and EOS will provide global measurements to complement the NDSC.

QUESTION 2:

What are the remaining key research questions concerning the ozone layer? Is there international consensus among scientists on these questions?

ANSWER 2:

Despite significant recent advances in our knowledge and understanding of stratospheric ozone, there are important questions which still remain. These scientific questions include:

- Will the Antarctic ozone hole expand spatially, seasonally, or influence ozone levels at mid- and extra-tropical latitudes in the southern hemisphere?
- Will an Arctic ozone hole develop, especially in years when stratospheric temperatures are particularly low and the vortex remains stable into springtime?
- What is the cause of the observed decrease in ozone between 30 and 65 degrees North latitude in winter since 1970?
- Will a mid-latitude volcanic eruption, where the effluents enter the atmosphere, cause a CFC-induced loss of ozone driven by heterogeneous reactions on volcanic aerosol surfaces?
- What are the atmospheric lifetimes of CFC's and HCFC's?
- Are there any adverse environmental impacts of HCFC's and HFC's?

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